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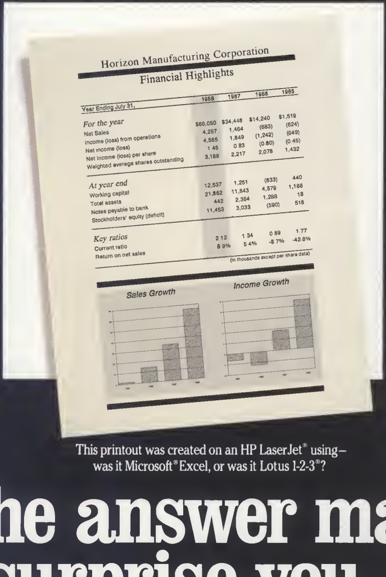

Horizon Manufacturing Corporation

Financial Highlights

Year Ending July 31,	1988	1987	1986	1985
For the year				
Net Sales	$66,050	$34,448	$14,240	$1,519
Income (loss) from operations	4,257	1,464	(683)	(624)
Net income (loss)	4,585	1,849	(1,242)	(649)
Net income (loss) per share	1.45	0.83	(0.80)	(0.45)
Weighted average shares outstanding	3,188	2,217	2,078	1,432
At year end				
Working capital	12,537	1,251	(833)	440
Total assets	21,862	11,843	4,579	1,188
Notes payable to bank	442	2,364	1,288	18
Stockholders' equity (deficit)	11,453	3,033	(590)	518
Key ratios				
Current ratio	2.12	1.34	0.89	1.77
Return on net sales	6.9%	5.4%	-8.7%	-42.8%

(in thousands except per share data)

Sales Growth

Income Growth

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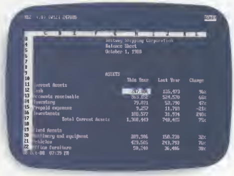

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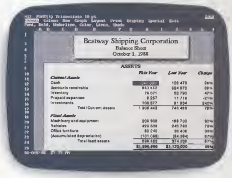

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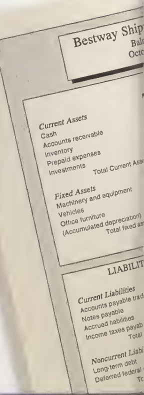

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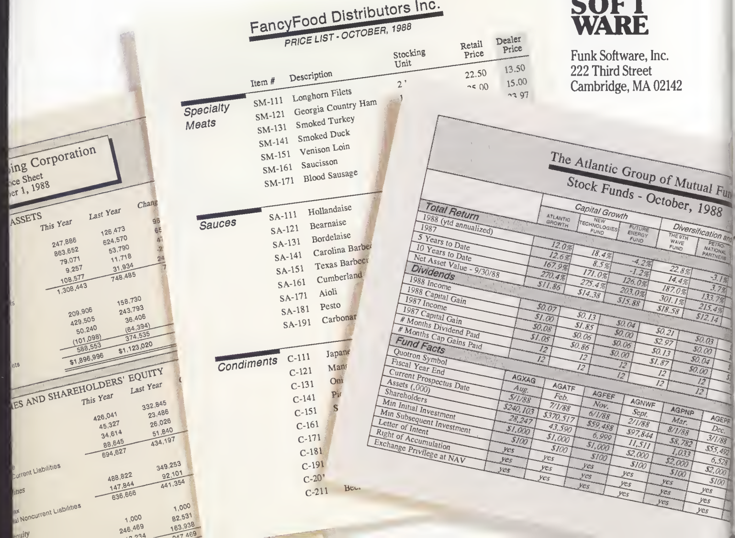

ing Corporation
ce Sheet
er 1, 1988

ASSETS	This Year	Last Year	Chang
	247,886	126,473	96
	863,652	624,570	65
	79,071	53,790	47
	9,257	11,718	-2
	108,577	31,934	24
	1,308,443	748,485	7
s	209,906	158,730	
	429,505	243,793	
	50,240	36,406	
	(101,098)	(64,394)	
	588,553	374,535	
ets	$1,896,996	$1,123,020	

ES AND SHAREHOLDERS' EQUITY	This Year	Last Year
	426,041	332,845
	45,327	23,486
	34,614	26,026
	88,645	51,840
	694,627	434,197
e		
Current Liabilities	488,822	349,253
	147,844	92,101
ities	636,666	441,354
ax	1,000	1,000
al Noncurrent Liabilities	246,469	82,531
	[illegible]	163,938
quity		[illegible]

FancyFood Distributors Inc.
PRICE LIST - OCTOBER, 1988

	Item #	Description	Stocking Unit	Retail Price	Dealer Price
Specialty Meats	SM-111	Longhorn Filets	[illegible]	22.50	13.50
	SM-121	Georgia Country Ham		[illegible]	15.00
	SM-131	Smoked Turkey			[illegible]
	SM-141	Smoked Duck			
	SM-151	Venison Loin			
	SM-161	Saucisson			
	SM-171	Blood Sausage			
Sauces	SA-111	Hollandaise			
	SA-121	Bearnaise			
	SA-131	Bordelaise			
	SA-141	Carolina Barbe			
	SA-151	Texas Barbec			
	SA-161	Cumberland			
	SA-171	Aioli			
	SA-181	Pesto			
	SA-191	Carbonar			
Condiments	C-111	Japane			
	C-121	Man			
	C-131	Oni			
	C-141	Pi			
	C-151	S			
	C-161				
	C-171				
	C-181				
	C-191				
	C-20				
	C-211	Bee			

The Atlantic Group of Mutual Fu
Stock Funds - October, 1988

	Capital Growth			Diversification and		
	ATLANTIC GROWTH	NEW TECHNOLOGIES FUND	FUTURE ENERGY FUND	THE 9TH WAVE FUND	PETRO-NATIONAL PARTNERS	
Total Return						
1988 (ytd annualized)	12.0%	18.4%	-4.2%	22.8%	-3.1%	
1987	12.6%	8.5%	-1.2%	14.4%	3.7%	
5 Years to Date	167.9%	171.0%	126.0%	187.0%	133.7%	
10 Years to Date	270.4%	275.4%	203.0%	301.1%	215.4%	
Net Asset Value - 9/30/88	$11.86	$14.38	$15.88	$18.58	$12.14	
Dividends						
1988 Income	$0.07	$0.13	$0.04	$0.21	$0.03	
1988 Capital Gain	$1.00	$1.85	$0.00	$2.97	$0.00	
1987 Income	$0.08	$0.06	$0.06	$0.13	$0.04	
1987 Capital Gain	$1.05	$0.86	$0.00	$1.87	$0.00	
# Months Dividend Paid	12	12	12	12	12	
# Months Cap Gains Paid	12	12	12	12	12	
Fund Facts						
Quotron Symbol	AGXAG	AGATF	AGFEF	AGNWF	AGPNP	AGEPF
Fiscal Year End	Aug.	Feb.	Nov.	Sept.	Mar.	Dec.
Current Prospectus Date	5/1/88	7/1/88	6/1/88	2/1/88	8/1/88	3/1/88
Assets (,000)	$240,103	$370,517	$59,488	$97,844	$8,782	$55,492
Shareholders	28,247	43,590	6,999	11,511	1,033	6,528
Min Initial Investment	$1,000	$1,000	$1,000	$2,000	$2,000	$2,000
Min Subsequent Investment	$100	$100	$100	$100	$100	$100
Letter of Intent	yes	yes	yes	yes	yes	yes
Right of Accumulation	yes	yes	yes	yes	yes	yes
Exchange Privilege at NAV	yes	yes	yes	yes	yes	yes

LOTUS

104 *Inside-out logic*

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STAFF LETTER

WE'RE PRESENTING THINGS A BIT DIFFERENTLY

Putting out a magazine each month entails enough work to keep us busy around here. So it is all too easy to just keep doing it, without stopping to think about whether we're still putting out the magazine that will do the most for you.

Mindful of that trap, we have been forcing ourselves lately to take time out to talk about ways to do the job better. Not surprisingly, we find we don't all agree on everything. We still have a lot of thinking and planning to do, but we definitely will be making some changes in the magazine.

In fact, you can see a couple of those changes in this issue. One is in the New Products section. Last August we switched to an attractive, modular display of products, and some of you told us that you like it a lot. Nevertheless, we abandon it in this issue in favor of a more efficient and more flexible format that will let us inform you about more products and tailor the length of items as needed. We are also adding a table of contents for new products—page 94 in this issue—to help you locate certain categories of products.

The other obvious change is in the major articles. If you look at the Finance or Accounting department or the feature on page 59, you will see a new kind of setup box. It contains all the keystrokes you need to build the model described in the article when you start from an empty worksheet. We're confident that you'll find it easier to use the box than to dig the information out of the text. However, we'll use the old approach when we think that it's better to integrate the keystrokes tightly with tutorial copy.

Changes aimed at making life easier for you did not start with this issue. Increasingly, we have been using tinted blocks to highlight ranges and functional areas in our spreadsheets. A tint with an attached name is easier to pick out than something like C3..D16. The challenge is to do this without adding confusion to the visual presentation.

We are also experimenting with our type, in an effort to make it more legible. And we have begun to use bolder subheads, to make it easier for you to skim the text to find what you need.

All these changes, and there are more to come, have to do with presentation, not content. But we are also working on changes in content. We'll have more to say about those in months to come.

Meanwhile, use the comment portion of the postage-paid Editorial Evaluation card to tell us whether we're on the right track. Or, for that matter, to tell us anything else—about content, presentation, Lotus programs, other software, or the state of the PC world.

The Editors

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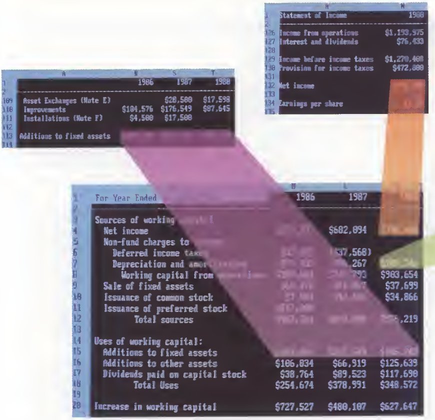
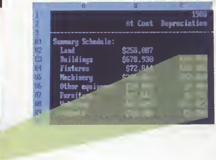


```
      A                                  R         S         T
 1                                     1986      1987      1988
 2  --------------------------------------------------------------
109  Asset Exchanges (Note E)                   $28,500   $17,598
110  Improvements                  $104,576   $176,549   $87,645
111  Installations (Note F)          $4,500    $17,500
112
113  Additions to fixed assets
114
```

```
      M                                  N
 1   Statement of Income              1988
 2   ----------------------------------------
126  Income from operations      $1,193,975
127  Interest and dividends         $76,433
128
129  Income before income taxes  $1,270,408
130  Provision for income taxes    $472,000
131
132  Net income
133
134  Earnings per share
135
```

```
                                            B          L
 1   For Year Ended                       1986       1987
 2
 3   Sources of working
 4     Net income                                 $682,094
 5     Non-fund charges to
 6       Deferred income tax                     ($37,568)
 7       Depreciation and amor                        ,267
 8         Working capital from                         793   $903,654
 9     Sale of fixed assets                                    $37,699
10     Issuance of common stock                                $34,866
11     Issuance of preferred stock
12           Total sources                                        ,219
13
14   Uses of working capital:
15     Additions to fixed assets
16     Additions to other assets          $106,834   $66,919  $125,639
17     Dividends paid on capital stock     $38,764   $89,523  $117,690
18           Total Uses                   $254,674  $378,991  $348,572
19
20   Increase in working capital          $727,527  $480,107  $627,647
```



```
      A                    B            C
 1                                   1988
 2                   At Cost  Depreciation
 3   ------------------------------------------
 81  Summary Schedule:
 82    Land             $258,087
 83    Buildings        $678,938
 84    Fixtures          $72,84
 85    Machinery
 86    Other equi
 87    Furnit
```

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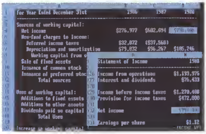

```
     A                                     B          C          D
 1  For Year Ended December 31st          1986       1987       1988
 2  -----------------------------------------------------------------
 3  Sources of working capital:
 4    Net income                      $276,977   $682,094   $798,400
 5    Non-fund charges to Income:
 6      Deferred income taxes          $32,072   ($37,568)
 7      Depreciation and amortization  $79,832    $96,267   $185,246
 8        Working capital from o
 9    Sale of fixed assets          1   Statement of Income          1988
10    Issuance of common stock      2   ---------------------------------
11    Issuance of preferred stoc  126   Income from operations $1,193,975
12          Total sources         127   Interest and dividends    $76,433
13                                128
14  Uses of working capital:      129   Income before income taxes $1,270,408
15    Additions to fixed assets   130   Provision for income taxes  $472,000
16    Additions to other assets   131
17    Dividends paid on capital   132   Net income
18          Total Uses            133
19                                134   Earnings per share            $1.12
20  Increase in working capital                                  INCOME WK1
```

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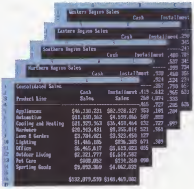

```
Western Region Sales
                        Cash      Installment
Eastern Region Sales
                        Cash      Installment
Southern Region Sales
                        Cash      Installment
Northern Region Sales
                        Cash      Installment
Consolidated Sales
                        Cash      Installment
Product Line            Sales        Sales
--------------------------------------------
Appliances         $46,130,231  $82,928,127
Automotive         $11,150,162   $4,598,066
Cooling and Heating $21,529,563 $36,418,464
Hardware           $20,913,431   $8,355,814
Lawn & Garden       $3,704,021   $3,523,450
Lighting            $1,466,105     $836,383
Office              $6,465,617   $5,613,023
Outdoor Living      $2,321,777   $1,614,582
Pet Care              $808,052     $134,260
Sporting Goods      $9,893,369   $4,062,033

                  $132,879,595 $148,469,082
```

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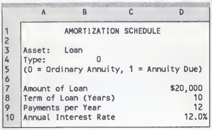
LOANS: EARLY PAYMENT AND LET THE BANK DO IT

I read with interest Stephen Nelson's "Track the Payments on Your Loan" [September]. I haven't been able to set up a spreadsheet that takes into account additional payments made against a loan. No interest is charged on the additional payments, and the loan is reduced by the amount of the extra payment. The objective is to figure out how quickly the loan can be paid off with the extra payments.

Gayle Johnson
Englewood, Colo

Author's note: *Assume that the payments on a $20,000, 10-year loan are due at the end of each month. Retrieve the amortization worksheet shown in the article, enter the label and values shown in ranges B3..B4 and D7..D10 in the figure below, and press CALC.*



```
        A         B         C          D

1              AMORTIZATION SCHEDULE
2
3   Asset:    Loan
4   Type:               0
5   (0 = Ordinary Annuity, 1 = Annuity Due)
6
7   Amount of Loan                   $20,000
8   Term of Loan (Years)                  10
9   Payments per Year                     12
10  Annual Interest Rate               12.0%
```

Now modify your worksheet. Enter the labels in column E (next figure), beginning each one with a space.

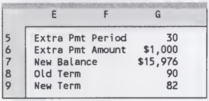
Assign the Fixed format with no decimal places to cell G5 and range G8..G9, then assign the Currency format with no decimal places to range G6..G7. Enter the following formulas:

Cell	**Formula**
G7	@VLOOKUP(G5,A15..D134,1) −G6
G8	+D8∗D9−G5
G9	−@TERM(D11,D10/D9, −G7∗(1+D10/D9∗B4))

The formulas in cells G7 and G9 will return ERR initially.

Assume the next payment due on the loan is the 30th payment and you have an extra $1,000 to pay into your loan. Enter 30 *in cell G5, enter* 1000 *in cell G6, and press CALC.*

The values in cells G8 and G9 tell you that you previously had 90 more payments to make on your loan and that after you pay the extra $1,000, you have 83 payments left.



```
         E          F          G

5    Extra Pmt Period          30
6    Extra Pmt Amount      $1,000
7    New Balance          $15,976
8    Old Term                  90
9    New Term                  82
```

Many amortization programs are available to help you track your loan payments. There are also financial-analysis tools and commercial *1-2-3* templates to perform other functions. Too many people try to reinvent the wheel and end up with just a radial when they're looking for a snow tire. Why build an amortization worksheet to analyze a loan when the bank can provide you one free of charge?

Lance K. Mertz, CPA, CMA
Snohomish, Wash.

Editor's note: LOTUS *has published many spreadsheet models that duplicate the functions of specialized software packages. We believe many of our readers prefer to meet a need with software they already own and know how to use than with a stand-alone product.*

Furthermore, some dedicated accounting packages, including the best-selling small business package, DacEasy Accounting, *don't produce amortization schedules.*

Many banks do not provide amortization schedules.

Finally, the bank isn't the user of your amortization table, you are—for your monthly income statements and balance sheets.

TO PAGE UP OR DOWN

Thanks for "Inside Release 3" [August]. I hope it's not too late for the product developers to correct a mistake. You say "Holding down the Control key and pressing PageUp moves the cell pointer to the next worksheet. Holding down the Control key and pressing PageDown moves to the previous worksheet." This is backwards! Just as PageDown moves to the next page, so Control-PageDown should move to the next worksheet, not the previous one. The excellent public domain file-viewing utility, *List*, uses Control-PageDown and Control-PageUp in this way.

William Meacham, Systems Analyst
Sheshunoff Information Services
Austin, Tex.

Editor's note: *We passed Mr. Meacham's comment to Scott Tucker, Director of Product Design in the PC Spreadsheet Division, at Lotus Development Corp. His comment follows.*

Navigation in *1-2-3* tends to be visually oriented. The keystrokes for three-dimensional navigation were matched to Release 3's method of 3-D viewing, namely Perspective mode, in which the next worksheet is shown behind and projecting above the current worksheet. Perspective mode provides a natural, intuitive way to display consecutive sheets. For most users, Control-PageUp is the preferred keystroke to select the next sheet when in Perspective mode.

NO SUCH THING AS FREE SUPPORT

Henry Fersko-Weiss's article "More Companies Are Charging for Support" [September] was very interesting. The customer inevitably pays for customer support, either as a separate fee or built into the price of the software. The question is not who foots the bill, but how customers prefer to pay it.

Mara Scherbarth, Administrative Specialist
Employee Benefits Division
Time Insurance Co.
Milwaukee, Wis

THOSE @FUNCTIONS KEEP COMING

Editor's note: *We asked readers to send us suggestions for new @functions.*

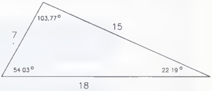
I would like to share with your readers a strange @function that occasionally autoexecutes in our Lotus applications. This seems to be related to the program's complexity, our degree of need, and how fast we must have the results. We named it @HAPPENS. Any argument we try to apply makes no difference in the consistent results this @function provides.

Ed Flanagan, President
Central Supply Co.
Orlando, Fla

PUT YOUR TRIANGLES IN ORDER

As a design professional I have solved triangle-related problems many times. I have even developed a BASIC program to do it on my pocket computer.

When I used the spreadsheet and sample data in "Sine Here, Please" [June], my results were correct. Then, when I tried to solve a triangle with side lengths 18, 15, and 7, the angles I got were 49.74, 54.03, and 76.23. I ran my own program and got different results that seemed to make more sense. I even drew a sketch to scale (see the figure) and the results confirmed my suspicions. Your spreadsheet appears to be in error.



Jerzy Czarnik
CXT Ltd.
Edmonton, Alberta

Editor's note: *The order in which you enter values makes a difference. Referring to the diagram in the upper-left corner of the Triangle Solutions worksheet (figure 2 in the article), you see that the 7-unit side of your triangle is side 1, the 15-unit side is side 2, and the 18-unit side is side 3. You entered 15 for side 1, 18 for side 2, and 7 for side 3. If you enter the numbers 7, 15, and 18 in cells C22, C23, and C24, the worksheet's results match the angles in your sketch.* ■

Letters to the editor should be sent to Letters Editor, LOTUS *Magazine, P. O. Box 9123, Cambridge, MA 02139–9123. Letters may be edited for length and clarity.*

@ERR

"The Day-of-the-Week Problem" (October): The comma that appears after @DATE should be placed after ,7). The correct formula is:

```
@CHOOSE(@MOD(@DATE(year,
  month,day),7),"Saturday",
  "Sunday","Monday","Tuesday",
  "Wednesday","Thursday","Friday")
```

"The Return-on Equity Calculator" (October): Using the formulas listed on page 45, cell J33 returns 11.8% when sales increase by 10%, rather than 11.1%, which is the return on equity stated in the article. The problem is in the financial leverage formula in cell J27. This formula should be +E20/E18. Thanks to Gerard L. Rattenbury of Detroit for alerting us to the error.

Good Ideas, "Navigating Several Directory Levels" (October): After selecting /File Directory, you should enter *.\orders*. The period was lost in printing.

"With Sincere Depreciation, Part 2" (July): The instructions on page 45 should tell you to change the value in cell D13 to 1 after changing the value in cell D12 to 31.5. Then press the CALC key. The figure and your spreadsheet should display 0.02 in cell D29 and 0.03 in the cells in range E29..M29. Thanks to Martin A. Parmer of Rocky Face, Ga., for the correction.

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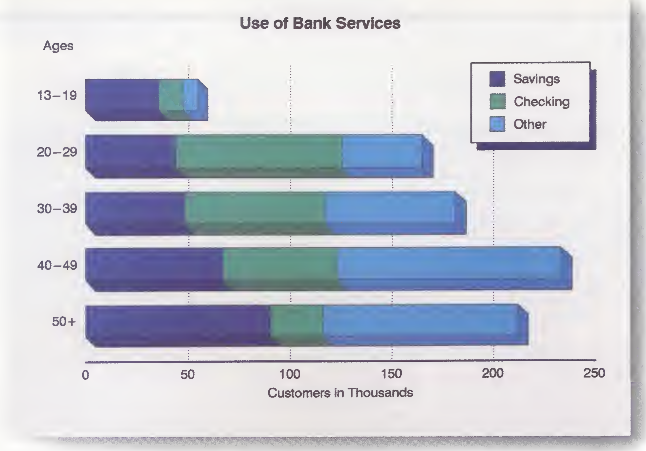

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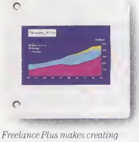

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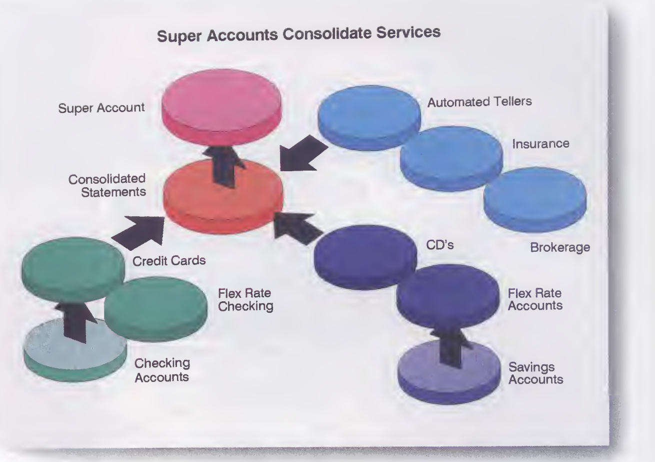

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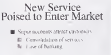

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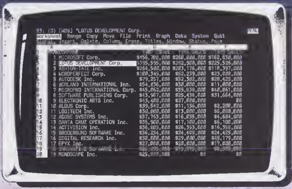
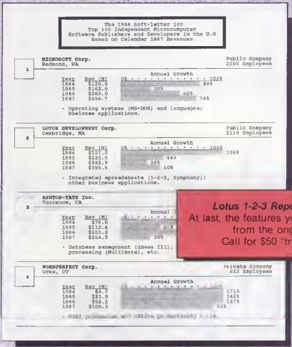


```
B3: (G) [W20] 'LOTUS DEVELOPMENT Corp.                          MENU
Worksheet  Range  Copy  Move  File  Print  Graph  Data  System  Quit
Global, Insert, Delete, Column, Erase, Titles, Window, Status, Page
 1  RANKCOMPANY                     [illegible]  [illegible]  [illegible]
 2    1 MICROSOFT Corp.              $456,700,000 $260,000,000 $162,630,000
 3    2 LOTUS DEVELOPMENT Corp.      $395,595,000 $282,900,000 $225,526,000
 4    3 ASHTON-TATE Inc.             $264,500,000 $203,176,000 $118,397,000
 5    4 WORDPERFECT Corp.            $100,345,000  $52,239,000  $23,000,000
 6    5 AUTODESK Inc.                 $79,257,000  $52,302,000  $28,425,000
 7    6 BORLAND INTERNATIONAL Inc.    $54,036,000  $30,000,000  $11,000,000
 8    7 MICROPRO INTERNATIONAL Corp.  $45,062,000  $35,830,000  $40,061,000
 9    8 SOFTWARE PUBLISHING Corp.     $43,987,000  $25,438,000  $31,664,000
10    9 ELECTRONIC ARTS Inc.          $43,400,000  $27,000,000           $0
11   10 ALDUS Corp.                   $39,542,000  $11,136,000   $2,200,000
12   11 LOGITECH Inc.                 $30,000,000  $13,000,000   $6,000,000
13   12 ADOBE SYSTEMS Inc.            $37,763,000  $16,055,000   $4,604,000
14   13 SANTA CRUZ OPERATION Inc.     $36,900,000  $17,100,000   $6,100,000
15   14 ACTIVISION Inc.               $36,805,000  $26,353,000  $16,358,000
16   15 BRODERBUND SOFTWARE Inc.      $36,234,000  $24,408,000  $24,425,000
17   16 DIGITAL RESEARCH Inc.         $30,000,000  $29,000,000  $45,179,000
18   17 EPYX Inc.                     $27,000,000  $20,000,000  $17,000,000
19   18 INNOVATIVE SOFTWARE Inc.      [illegible]  [illegible]  [illegible]
20   19 MINDSCAPE Inc.                $25,000,000           $0           $0
```

◀ **A Lotus database is a range or an entire worksheet having field names in the first row and records of data in rows below.**



```
                    The 1988 Soft·letter 100
              Top 100 Independent Microcomputer
        Software Publishers and Developers in the U.S.
                Based on Calendar 1987 Revenues

 1   MICROSOFT Corp.                                  Public Company
     Redmond, WA                                      2200 Employees
                                Annual Growth
           Year   Rev (M)    0% . . . . . . . . . . . . . 100%
           1984   $125.0                                  80%
           1985   $162.6                 30%
           1986   $260.0                          60%
           1987   $456.7                                76%
         · Operating systems (MS-DOS) and languages;
           business applications.

 2   LOTUS DEVELOPMENT Corp.                          Public Company
     Cambridge, MA                                    2119 Employees
                                Annual Growth
           Year   Rev (M)    0% . . . . . . . . . . . . . 100%
           1984   $157.0                                      196%
           1985   $225.5                  44%
           1986   $282.9               25%
           1987   $395.6                 40%
         · Integrated spreadsheets (1-2-3, Symphony);
           other business applications.

 3   ASHTON-TATE Inc.
     Torrance, CA
                                Annual
           Year   Rev (M)
           1984    $79.0
           1985   $110.4
           1986   $203.2
           1987   $264.5                30%
         · Database management (dBase III),
           processing (Multimate), etc.

 4   WORDPERFECT Corp.                               Private Company
     Orem, UT                                          612 Employees
                                Annual Growth
           Year   Rev (M)
           1984     $9.5                                      171%
           1985    $23.0                                      142%
           1986    $52.2                                      127%
           1987   $100.3                                   92%
```

◀ **A report is any printout or screen display of data from your database. Anything beyond simple listings of data requires complex macros, or can't be done with Lotus.**

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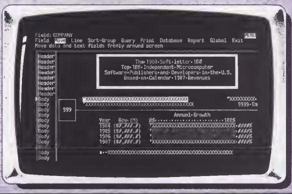


```
Field: COMPANY                                                      MENU
Field  Move  Line  Sort-Group  Query  Print  Database  Report  Global  Exit
Move data and text fields freely around screen
Header
Header                 The·1988·Soft·letter·100
Header          Top·100·Independent·Microcomputer
Header      Software·Publishers·and·Developers·in·the·U.S.
Header              Based·on·Calendar·1987·Revenues
Header
Header
Header
Body          'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX           "XXXXXXXXX·
Body    999   'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX            9999·Em
Body
Body                               Annual·Growth
Body             Year   Rev·(M)    0%·.·.·.·.·.·.·.·.·.·.·.·100%
Body             1984  ($#,###.#)  'XXXXXXXXXXXXXXXXXXXXXXXXXXXXX·####%
Body             1985  ($#,###.#)  '[illegible]·####%
Body             1986  ($#,###.#)  '[illegible]·####%
Body             1987  ($#,###.#)  'XXXXXXXXXXXXXXXXXXXXXXXXXXXXX·####%
Body
Body             ·-XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Body
```

◀ **A report writer is a tool that lets you specify what data to select, what additional calculations to perform, where to place everything, and exactly how it should look.**

Trademarks: Lotus, 1-2-3, Symphony, Lotus Report Writer by Lotus Development Corporation; IBM by International Business Machines Corporation; dBASE by Ashton-Tate; R&R Relational Report Writer and R&R Worksheet Report Writer by Concentric Data Systems, Inc.

IT'S TAX TIME

You need a PC to cut through the jungle of new rules.

Midnight, April 15, 1988. At tax preparers' offices throughout the country, the champagne corks started popping. Several New Hampshire offices of H&R Block presented employees with T-shirts sporting the message "Survivor—TRA '86."

The Tax Reform Act of 1986 has had profound effects on taxpayers and tax preparers alike. It is a jungle of new rules, new regulations, and new concepts. And the 1987 tax year was only the beginning. The act's provisions will continue to be phased in over the next several years.

An immediate effect of the new law was the creation of a hot market for tax-preparation and tax-planning software. Many tax professionals regard a computer as a necessity today. One reason is the tight integration of tax forms, where information on one form is dependent on others, says Mike Chipman, president of ChipSoft (San Diego, Calif.), whose *TurboTax* ($75) is one of the leading tax programs for PCs. Another reason is the sheer complexity of the new tax law. The new laws are "contrary to many traditional tax concepts," says Dr. J. E. Howard, president of HowardSoft (La Jolla, Calif.), maker of *Tax Preparer* ($295). "And," he adds, "the IRS has not successfully translated all the provisions of the law into its tax forms."

Inaccuracy and confusion

The Tax Reform Act is at best a set of specific guidelines, which the IRS must interpret in its regulations and forms. This is not always simple. A case in point involves so-called passive losses—those you claim for a business in which you did not play an active role. Although the new law on passive losses prevailed throughout 1987, the IRS failed to release all of the regulations concerning passive losses and the instructions for the related tax forms until late in the filing season.

This year's round of tax-law changes could be equally confusing. Two tax bills, the Technical Corrections Act and the Miscellaneous Revenue Act, were passed late in 1987 (and have since been combined into a single bill) in an attempt to address inaccuracies and confusion in the original act. In addition, certain nontax bills, such as the Family Support Act of 1988, contain provisions that affect the tax law.

All of this adds up to a nightmare for developers of tax software, who must scramble to incorporate the latest changes and ship the updated software as far in advance of January 1 as possible. The updates can be extensive: Harry Chud, president of TaxCalc Software (Fort Worth, Tex.), says the most recent version of *TaxCalc* ($250), the company's *1-2-3* tax-planning template, is 30% larger than it was last year. Chip-

ROBBIE MARANTZ

Soft's Chipman says that *TurboTax*'s calculation algorithm quadrupled in size from 1987 to 1988 and will grow even more this year. In the meantime, developers are crossing their collective fingers and praying that the IRS doesn't make any major changes in the regulations after the first of this year. Last year's passive-loss fiasco forced companies to ship updates in the middle of the tax season.

The complexity of the new tax law has resulted in increasingly sophisticated tax-preparation software. Extensive context-sensitive help is the rule, and some programs are incorporating artificial-intelligence concepts. For example, *Ask Dan About Your Taxes* ($89.95, from Legal Knowledge Systems, Drexel Hill, Pa.) uses a rule-based expert system to supplement its straightforward computations. As you answer its questions, the program "learns" your tax situation and generates a list of income items and deductions specific to your situation. But many developers are wary of the fine line between providing what the IRS calls mechanical assistance and actually giving advice or making decisions, which would, according to IRS regulations, make the developer a "preparer." The IRS holds preparers liable for advice given negligently or for negligence and can assess penalties.

No substitute for a pro

Not everyone agrees that computers are the ultimate answer to coping with the tax laws. H&R Block, the nation's largest tax service, doesn't equip its company-owned offices with computers for tax preparation. Judy Keisling, Block's manager of tax research and training, says there's no substitute for a trained and experienced preparer. A computer "can't do an in-depth interview," she says, "or advise taxpayers of their options in complicated situations."

However, H&R Block doesn't eschew computers completely. This year, many of its employees will be among the 10,000 to 12,000 professional preparers using the IRS's electronic-filing program. The program began experimentally in 1986 and this year will cover 36 states. By filing time for 1989 taxes, electronic filing will be available to preparers nationwide.

The electronic-filing program allows professional preparers to transmit returns via modem directly to IRS computers at two regional service centers. Dick Moran, the IRS's program manager for electronic-filing systems, says there are advantages for both the IRS and taxpayers. For the IRS, he says, electronic filing eliminates the problems of recruiting and training legions of temporary workers each year. It also eliminates a great deal of manual handling and the errors that result. For taxpayers, the payoff is quicker refunds. A re-

BEFORE YOU COMPUTERIZE . . .

Before you buy a tax package, follow these 11 tips.

1. Do you want a tax-preparation program or a tax-planning program? The former prepares the forms; the latter helps you plan ahead and estimate your future tax liability. Some tax-preparation programs, such as *TurboTax*, also have a tax-planning feature.

2. Does the program give you an actual on-screen form to work with? Many packages provide menu-driven questions for you to answer, which can be a boon if the forms and schedules intimidate you. But this method may frustrate you if you're accustomed to looking at a form and following its logic.

3. Does the program have error-checking capabilities? A well-designed program should prevent you from making both obvious and subtle mistakes. For example, the program should reject a letter entry in a social security number or alert you if you've entered more than the allowable maximum for charitable contributions.

4. How quickly does the program perform calculations? Many packages are written in BASIC, resulting in molasses-slow recalculation. The better packages are written in faster languages such as Pascal or C. Also, make sure you can control when the program recalculates; otherwise, it may do so after every entry.

5. Does the program have all the forms you need? If you need less common forms, such as Schedules C (Sole Proprietorship) and SE (Self Employment Tax) or Forms 2106 (Employee Business Expense) or 8615 (Child with Investment Income), make sure the package contains them.

6. If your state taxes are complicated, find out if the company sells state tax modules in addition to its federal tax program. If the company has a module for your state, is it integrated with the federal program or will you have to reenter your numbers?

7. Can you use the program to prepare only the forms you need? Some packages force you to prepare the entire return, but you may want to fill out only one or two forms.

8. Can the program handle "what-if" situations? The program should allow you to try different strategies and scenarios, especially for complex forms. Some programs provide side-by-side comparisons.

9. Does the company support its products? Tax-preparation programs are subject to the same bugs and problems as any large application, so make sure the company doesn't shut down its customer-service department on April 1. In addition, make sure the company offers annual updates at a reasonable cost.

10. Is the documentation effective? You're not only learning the application, you may need tax-law information as well. Your package should come with clearly written documentation and well-indexed reference material keyed to the IRS instructions.

11. Will the program import data from other packages? Some packages can import data directly from *1-2-3* or popular personal-finance programs. Such a feature can make filling out your return or planning next year's strategy a lot less painful. *—S. M.*

fund check or an electronic direct deposit from an electronically filed return could be on its way to the taxpayer in as few as 17 days, compared with 8 to 10 weeks for a paper return, Moran says.

Because data security is an important consideration, the IRS accepts electronic returns only from registered, password-equipped preparers, and the data must be transmitted in a specific format. Furthermore, electronic filers do not dial into the main nationwide IRS computer network. Instead, they transmit data to stand-alone minicomputers. Several times a day, the IRS off-loads the data from the minicomputers onto reels of computer tape, which are then physically moved to the agency's tightly protected mainframes.

Will individual taxpayers ever be able to transmit their returns to the IRS? "Probably not," says Moran, "at least not with existing technology." Aside from the security concern, he says, IRS computers don't have the capacity. Some 106 million tax returns were filed in 1988, and if even a fraction were directly transmitted, the IRS would have to overhaul its telecommunications capabilities.

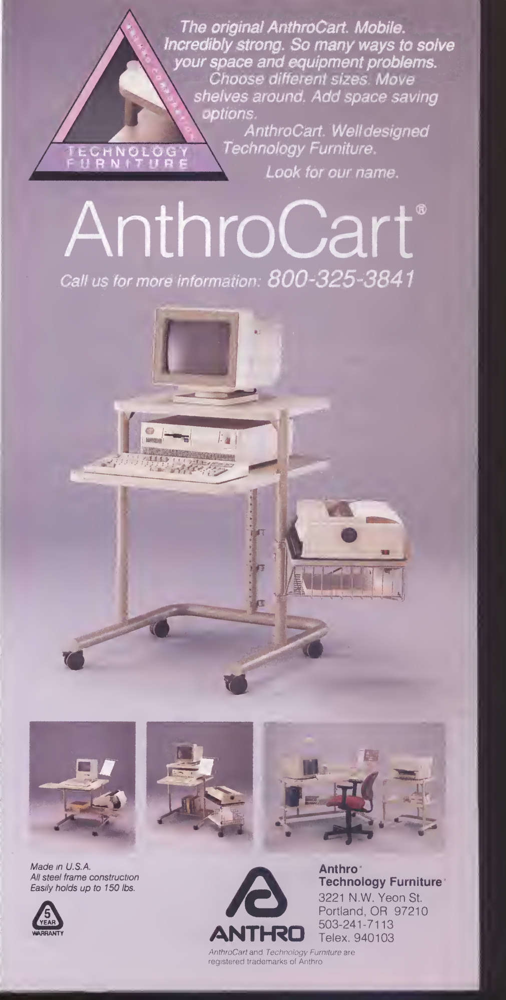
Yet Moran strongly believes that electronic filing has a bright future. Someday, he hopes, you'll be able to insert a floppy disk with your personal tax data into an automatic-teller-like machine that will transmit the information directly to the IRS. —*Stan Miastkowski*

DIGITAL ARCHIVES: WILL THEY BE ACCESSIBLE?

Storing data isn't the problem, retrieving it later is.

No one really knows how long magnetic data will last, since the magnetic-storage business has been around for only 45 years. But Michael Sheridan, technical director for 3M's Data Storage Products Division, believes that magnetic data "will last indefinitely if nothing causes it to be erased." And with reasonable care, say storage-media experts, the current generation of magnetic disks and tapes may outlast the businesses and individuals that produce them.

That's the good news. The bad news is that even a few years down the road, you might not be able to find the right



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hardware to read those records. "The problem with machine-readable archives is that the technology is often shorter-lived than the media," explains William Holmes, director of the Research and Evaluation Group for technology assessment at the National Archives, in Washington, D.C.

Storage may be for decades

If you have vital business data on your PC earmarked for archival storage, that could spell trouble. For example, companies must retain pension records for decades. Some types of employee health and safety records must be saved indefinitely. And while you normally have to save tax records for only three years, you must keep any documents or figures "as long as they are relevant" to support deductions or original costs, says IRS spokesman Larry Wright.

The basic problem, say archiving experts, is the computer industry's obsession with five-year product generations. Already, notes Holmes, 8-inch floppy-disk drives are scarce. This issue is especially worrisome in the PC world, where disk and tape formats change rapidly. Mark Mackaman, Microsoft's OS/2 product manager, says DOS will always provide a way to read previous storage formats. However, you must have the drive that fits the disk. Consequently, says Holmes, you may have to save the hardware as well as the media, and a disk drive is considerably harder to maintain. "Suppose you pull out an old drive in a few years and it doesn't work?" he asks. "Who's going to have parts?"

That's one reason, Holmes says, that the National Archives accepts data only on standard media and rewrites digital data every 10 years, using whatever technology is currently the most prevalent. For the same reason, despite the attractiveness of optical technology for permanent, nonerasable storage with high information density, the Archives is being cautious. "A couple of manufacturers claim a life of 100 years for their media," says Holmes, "but for us, the question is the life of the technology, not the life of the media."

Take 'reasonable' care

Emulating the Archives' policy in a corporate environment might be difficult. Meanwhile, you can and should take "reasonable but not extraordinary" care, says 3M's Sheridan, to ensure the safety of your disks and tapes over the long term. His company and other disk makers say that disks retain their integrity over a wide range of temperatures and humidities. For long-term storage, however, a location with controlled, moderate temperature and humidity is best, says Sheridan. An average air-conditioned office of 70 degrees and 50% humidity is fine.

If you're concerned with your office's storage conditions, you can send your tapes and disks to an off-site records center. For one thing, such a center provides a second location in case of fire or other disaster, says John Reis, vice president of DataSafe, a records center in San Francisco. In addition, he continues, a records center maintains a more controlled environment than an office, where the heat or air conditioning may be turned off over the weekend.

THE NATIONAL ARCHIVES REWRITES DATA EVERY 10 YEARS.

Storage costs, Reis says, depend mostly on the volume of material and how often it will be accessed. Typically, a company such as his will bring a special disk-packing case to your office, help you inventory and pack away your data, and store it for a cost of about 40 cents per floppy disk per month.

—Steve Rosenthal

APPLICATIONS THAT TALK TO EACH OTHER

The cold war of communications protocols may be ending.

In an ideal world, PC communications would be as simple as sending a document to a printer. No need to call up specialized software. Instead, just transmit any file to a fax machine, E-mail network, or another computer, without leaving your application.

We can't do this currently because of the lack of industry-standard communications protocols. Recently, however, Intel Corp. (Hillsboro, Oreg.) and Digital Communications Associates (Alpharetta, Ga.) announced the DCA/Intel Communicating Applications Specification (CAS), a set of public domain programming guidelines.

For PC users, the key part of the specification is the ability to send files from within an application. The specification addresses scheduling and execution, the two basic communications functions. Scheduling includes all communications technologies, from E-mail to fax transmission, and indicates the target (distribution list), the document, and the time of communication. Execution manages connection, transmission, and disconnection functions, ensuring that data is transmitted reliably.

In theory, says Stephen Saltzman, Intel's Connection CoProcessor product manager, CAS will mean less work for developers of applications programs, smoother operation for users, and a wider range of communications options for everyone. The CAS routines would allow a developer, for example, to incorporate a Send option into an application's main menu. The Send menu might then include choices for the transmission method and destination.

Heavyweight endorsement

Transmission methods and destinations will, in future versions of CAS, include various E-mail systems and dial-up and custom networks, says Saltzman. And an advanced version of CAS will support additional communications links, including micro-to-mainframe links. Although Intel and DCA are the primary sponsors of the communications pro-

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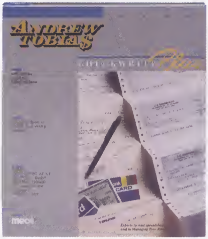

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CIRCLE 107 ON READER SERVICE CARD

posal, such industry heavyweights as Ashton-Tate, Borland International, Lotus Development Corp., Microsoft Corp., Novell, Symantec Corp., and WordPerfect Corp. are endorsing the specification.

The Intel connection

For Intel, the payoff could be increased sales of its recently announced Connection CoProcessor board, which conforms to CAS. The CoProcessor board ($995) has a 10-MHz 80188 microprocessor, 256K of memory, and a fax modem. A 2400-baud Hayes-compatible modem is available as an option. The board can assume communications tasks from the PC's central processor and perform them in the background while users continue with other computing tasks.

While the goal of simplifying communication processing is a noble one, some logistical questions remain. Jan Ozer, Quadram Corp.'s Facsimile general manager, notes that if you use only one application, then CAS is clearly better because you can send and receive data using the interface you know best. On the other hand, he asks, what if you use several applications? Must you learn a different fax-sending procedure for each application?

Despite these questions, Intel expects to see broad industry acceptance of the CAS standard within a couple of years. "Communications software will never disappear," says Saltzman. "You'll still need it for, say, interactive searches of an on-line database." However, he says, for batch communications, the new specification provides a much-needed "data dump truck."

—*Steve Rosenthal*

HAVE YOU BACKED UP YOUR HARD DISK TODAY?

If the answer is no, check out some new backup options.

Few computer users regularly back up the data on their hard disks, perhaps because the time, effort, and expense associated with backup systems can be daunting. However, new technologies and improvements to older methods are making this chore easier.

Disk-duplication products, removable-disk storage, tape-backup systems, and videocassette drives are available now, and new digital and optical storage technologies are on the horizon.

The most reliable way to ensure the safety of your data is to maintain a duplicate of your hard disk. Sometimes called mirroring, this method requires

INTERVIEW: USER GROUPS GROW UP

And Betty Brooks heads the biggest Lotus SIG.

Like the microcomputer industry itself, user groups have come out of the hobbyist's garage and into the big time. One of the largest groups is the Houston Area League of PC Users (HAL-PC). A few dozen computer enthusiasts organized HAL-PC in 1982. Today more than 8,000 fill the roster, and new members join at the rate of more than 100 a month. As many as 40% of them make a living using a PC.

With that kind of clout, when HAL-PC has something to say, the industry listens. HAL-PC's general monthly meetings draw an audience of from 2,000 to 2,500 people, and speakers have included Microsoft Chairman William Gates, Borland International Chairman Philippe Kahn, and Compaq Computer Corp. President Rod Canion. HAL-PC also boasts a 100-page monthly newsletter, three 24-hour electronic bulletin boards, and approximately 40 active special-interest groups (SIGs). Betty Brooks, a Houston computer consultant and coordinator of HAL-PC's Lotus SIG, recently spoke to reporter Lindsy Van Gelder about what makes HAL-PC tick.

LOTUS: What has made HAL-PC so successful?

B. B.: A couple of factors contributed to its success. Early on, the group had a great software library. Also, HAL-PC bought disks in volume and sold them to members at cost. Eventually, the group bought from 20,000 to 30,000 disks a month. Another major offering is our newsletter, which in my opinion is one of the best in the country. Our editor was the first to organize the disk-exchange program [that enables user-group newsletters across the country to reprint each other's articles]. We have a lot of industrious people and a board that strives to grow and change with the needs of the group.

HAL-PC works hard to get people to attend meetings. Recently, for example, we had two software "shoot-outs"—one for spreadsheets and one for word processors—to compare competitive products. I think the Boston Computer Society has as many members as we do, but a lot of them are primarily members by mail. In terms of attendance, we're by far the largest. Our size attracts vendors to our meetings, which in turn brings in more members. It's kind of a chicken and egg thing.

LOTUS: Has the group changed during the five years you've been involved with it?

B. B.: Of course it has grown. In the beginning people got together in a cafeteria. By the time I joined, we convened at a computer center, and the meetings were getting more crowded every time we met. We've had to relocate several times. The HAL-PC SIG now rents a big lecture hall that has a projection system at the University of Saint Thomas. A different SIG meets there every night of the month.

JIM CALDWELL

two hard disks and involves continuously updating the secondary disk so that it mirrors the primary disk.

Kolod Research (Glenview, Ill.), for example, sells an add-on card that controls this process on IBM PCs and compatible computers. Kolod's DFT (Disk Fault Tolerance) card works with the computer's existing hard-disk controller, continuously writing the same data to both disks and analyzing the disks themselves. The system automatically moves data from damaged disk sectors to unused sections of the disk, and if the primary disk fails, DFT automatically switches to the secondary disk without missing a beat. In addition to the DFT card, which costs $395, you need a second hard disk, which can cost from $250 for a 20-megabyte unit to $500 for a 40-megabyte disk.

Newer Technology (Wichita, Kans.) offers a software approach to the process. *No-Fault* ($195) is a RAM-resident program that copies new or altered data from your primary hard disk to a secondary disk automatically, at whatever time interval you specify. The company claims that the program also corrects bad sectors automatically.

Tape drives

Despite the relative effortlessness of disk duplication, tape-drive systems are the most widely used technology for backing up hard disks. Often called streaming-tape drives, because they take the data off your hard disk as a continuous stream of bits instead of file by file, they can store the entire contents of your hard disk on a single tape cartridge. However, choosing a tape-backup system for your computer can be confusing because of incompatibility among backup systems and between a particular system and your hard disk.

In addition, tape-backup systems aren't the most convenient to use. You must first format the tapes, a process that can take as long as a half hour per tape. After that, backing up a 40-megabyte hard disk can take 20 to 40 minutes. To make the backup process more convenient, most systems come with software that lets you schedule a backup to take place unattended at a specific time, such as after you've left your office for the day.

Of the several tape-drive standards for MS-DOS computers, the QIC-40 (quarter-inch tape) standard prevails. The 3½-inch DC 2000 cartridge conforms to the QIC-40 standard and stores 40 megabytes of data on a 205-foot tape. Some analysts believe that by the early 1990s, DC 2000 cartridges will hold a

Also, the members have become more knowledgeable and sophisticated. In the Lotus SIG, members used to create small, simple templates. Now you hear people complain that their computers are running out of memory. They do more programming, using Lotus macros.

LOTUS: What are some typical problems that users bring to the group, beginners or otherwise?

B. B.: Hardware connectivity is the biggest worry, especially getting printer drivers to work. A lot of questions concern laser printers. In the Lotus SIG, another big problem is how to get macros to work.

LOTUS: Are there any problems that are particular to such a large organization?

B. B.: Because of its size, all of HAL-PC's general meetings are videotaped for the local-access cable channel and are broadcast one day each month. We're considering taping some of the SIG meetings too.

LOTUS: User groups are a unique phenomenon; we don't form groups for the purpose of discussing our cars, for example. In the beginning there was a special need because people with no computer background were trying to cope with the technology and not getting a lot of support from their companies. Is that still true?

B. B.: User groups became strong because the industry realized it had to respond to us. It also realized that a large group provides an opportunity to take the pulse of a cross section of computer users. If a vendor presents a product here and it's not well received, chances are that it won't be well received in the marketplace.

LOTUS: So HAL-PC members get a lot of advance information on products?

B. B.: The HAL-PC Lotus SIG was the first user group to see *1-2-3* Release 3. I beta test many Lotus add-ins and other related products.

LOTUS: Do you also arrange software purchases?

B. B.: Sometimes, but it's difficult to get everyone to meet a deadline when deciding what to buy.

LOTUS: What do you look for in a guest speaker?

B. B.: In the Lotus SIG, I don't want someone who is blatantly commercial. My goal is to help people find out what kind of Lotus add-ins exist, what those products will do for them, and how they work.

LOTUS: Who won the spreadsheet shoot-out?

B. B.: *Shoot-out* may not be the best word for it because there was no clear-cut winner. Another member and I did pretty extensive benchmark tests on four products. We used *1-2-3* Release 2.01 as a standard against which *Microsoft Excel, Lucid 3-D, Surpass*, and *Quattro* were tested. We invited representatives from each company to give a presentation at the meeting at which we released the test findings.

We tried to point out that what makes the "best" program depends on your needs. A light spreadsheet user who works mainly with some other product, such as a word processor, might prefer *Lucid 3-D* because it is memory-resident and pops up only when you want to use it. But a heavy user would get fairly frustrated with it. *Quattro* is cheaper and does a lot of the same things that *1-2-3* does, at least until Release 3 comes out. And if you want to produce polished, pretty documents without using an add-on program, maybe you'll go for *Excel.*

LOTUS: Are you planning to have another shoot-out when Release 3 is out?

B. B.: We'd love to, but you can't imagine how hard it is to coordinate these events—getting five people from five companies in the same place at the same time. However, it's a great way for people to decide what to buy. ■

For more information, write to HAL-PC, P.O. Box 61266, Houston, TX 77208-1266; 713-524-2572.

gigabyte of data—the equivalent of fifty 20-megabyte hard disks.

The 5¼-inch DC 600 XTD cartridge can store 150 megabytes of data and is used most often with local area networks and multiuser systems. 3M is currently testing two cartridges that will be able to hold 250 and 320 megabytes of data, respectively.

Alloy Computer Products and Mountain Computer (Campbell, Calif.) are two of the better-known tape-drive manufacturers. The prices of tape-backup systems have come down over the past few years and now range from $400 to $1,200. DC-series tape cartridges cost $20 to $50 apiece.

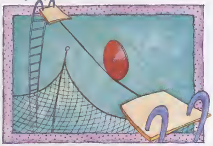
You can take it with you

If you need to carry backed-up data with you or send it to someone else, removable disk drives are a relatively new alternative. Removable-storage technology is divided into two camps: flexible-cartridge systems and Winchester-type hard drives. Flexible-cartridge systems are generally less expensive and more resistant to ill-treatment than are removable hard disks, but the tradeoffs are less data capacity, slower speed, and greater media wear.

The best known among the flexible-cartridge products is the Bernoulli Box, from Iomega (Roy, Utah). A Bernoulli Box is essentially an ultra-high-capacity floppy disk housed in a cartridge. It uses a variety of technological tricks to protect data, including air pressure that keeps the disk dust-free, and a disk that falls away from the read/write heads in the event of a power failure.

An internal single-drive Bernoulli Box ($1,100) holds 20 megabytes of data, and an internal dual-drive system ($2,000) stores 40 megabytes. Extra cartridges cost $83 each. In addition, you need an adapter board for your computer ($199 to $399).

Tandon Computer Corp. (Moorpark, Calif.) pioneered the removable-hard-disk category. Tandon's Ad-Pac system uses a 30-megabyte cartridge that the company claims can survive shocks of up to 300 g's (units of gravitational force)—about the equivalent of an 18-inch fall onto a hard floor—with no data damage. The Ad-Pac system, which includes a controller, an external disk drive, and one cartridge, costs $998; extra cartridges are $399 each.



ROBBIE MARANTZ

Another backup option is the videocassette. Alpha Microsystems (Santa Ana, Calif.) sells Videotrax, a $399 add-in board for IBM PCs and compatible computers that lets you connect a standard VHS videocassette player to your computer. You can then store up to 80 megabytes of data on a standard T-120 videocassette. A videocassette system generally backs up data at a rate of about 1.3 minutes per megabyte.

On the higher-capacity and higher-price side, Digi-Data Corp.'s (Jessup, Md.) GigaStore videocassette player can store a massive 2.5 gigabytes of data on a standard T-120 VHS videocassette. It sells for $5,975 for IBM PCs and compatible computers.

The newest technologies

Innovative tape technologies are beginning to threaten the preeminence of the older tape-backup systems. Digital audio tape (DAT), a technology developed for consumer audio applications, was a near-victim of heavy congressional lobbying by the music industry. However, more than a dozen companies, including Sony, Hewlett-Packard, Hitachi, and GigaTrend, are now adapting the technology for recording computer data. GigaTrend (Carlsbad, Calif.) was first on the market with a DAT backup system. The company's Giga 1200 drive will store as much as 1.2 gigabytes of data on a single 1½-by-2-inch DAT cassette. But here's the catch: the Giga 1200 costs $6,500. That high price will drop, of course, as the technology becomes more mainstream. Extra DAT cartridges cost about $10 each.

Jay Bretzmann, a market analyst for tape and optical storage with International Data Corp. (Framingham, Mass.), expects four or five DAT formats to compete for dominance over the next few years. GigaTrend has one proprietary format, and Hitachi is developing another. Hewlett-Packard and Sony have jointly adopted a third format, but each company will make available its own DAT drive. Bretzmann believes a standard format will emerge by 1991.

Over the long term, optical technologies seem to have a bright future. For $4,995, Advanced Graphic Applications (New York) offers an optical drive that lets you write and rewrite 650 megabytes of data to its disk (see New Products in the November issue).

But even when prices go down, not everyone will need the massive backup capacities of these new technologies. Nonetheless, the best advice is to buy and use a backup system for your hard disk. No matter how expensive and inconvenient the system may be, trying to recover lost data is much worse.

—Stan Miastkowski

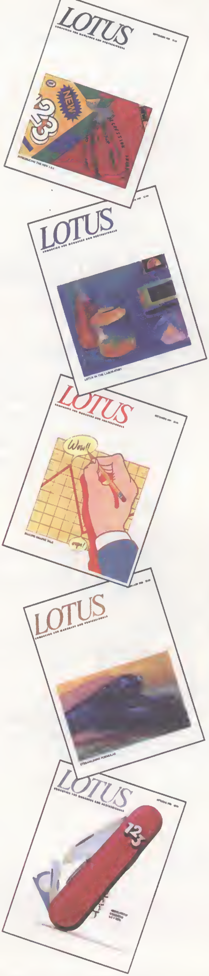
WHICH ONE SHOULD I GET?

Even among similar backup systems, the software that controls the backup process may differ. For example, does the system perform backups unattended? Can it back up and restore an individual file or a selected group of files? Can it back up and restore a selected file or files? Will it give you a directory of backed-up files?

Your budget will help you decide, but before choosing a backup system, spend some time thinking about the following questions:

- How much data do you need to back up? There's no point in buying a 150-megabyte backup system if your 20-megabyte hard disk is only half full. However, if you need to back up a lot of data, speed and convenience will be important.
- How often do you need to back up your files, and how much data will change between backups? If you work on only one or two files between backups, you'll want to back up just the files that have changed.
- How frequently will you need to access backed-up data? Find out how easy it is to restore your backed-up files and whether you can restore files selectively.
- What will happen to your backups? If you plan to travel with them, portability and ruggedness are important.

—Jennifer Smith



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Lotus Development Corp. has announced Lotus Prompt CD, a collection of 10 databases with information about all Lotus products, which is updated and delivered monthly on a CD-ROM.

Each CD-ROM contains technical support notes, product documentation, evaluation programs, *LOTUS* magazine, *Lotus Prompt Quarterly*, Lotus product demonstrations, Lotus add-ins, supplemental printer drivers, *1-2-3* Release 3.0 upgrade information, and Lotus Development Corp. press releases. Lotus's *BlueFish* search-and-retrieval software, which is included on each CD-ROM, lets you locate material with one or two reference words. A special command gives you access to what's new on each disk.

Lotus Prompt CD costs $995 per year and includes unlimited toll-free access to Lotus's technical support staff. You need an IBM PC XT, PC AT, PS/2, or certified-compatible computer with DOS 3.1 or higher and 640K of RAM, a hard disk with at least 500K available, and a CD-ROM drive. For more information, call Lotus Development Corp. at 800-367-6100.

NETWORK FOR ONE SOURCE TO SHIP IN 1989

CD/Networker, a software and hardware combination that allows Lotus One Source products to be shared across a network, will ship in the first quarter of 1989, Lotus Development Corp. announced. The One Source family of products consists of business and financial databases delivered on CD-ROMs. These are integrated with screening and analysis software.

The system's four main components are an 80386-based database server, CD-ROM readers, proprietary CD/Networker software, and One Source CD-ROM databases. The CD-ROM readers are attached to the database server, which regulates and processes requests from network users for One Source information.

CD/Networker works with Novell's Netware, the IBM PC Local Area Network, and the Banyan Vines and 3Com 3+ networks. In addition to the fee for the database server, annual costs are based on the One Source subscription and the number of nodes in your network. Annual fees include customer service and support.

LOTUS SHIPS VERSION OF AGENDA FOR OS/2

Lotus Agenda for OS/2, a new version of Lotus Development Corp.'s personal-information manager, shipped in November. Its features and functions are identical to the DOS version of *Agenda*, but *Agenda for OS/2* runs in the protected-mode environment of IBM's OS/2 Version 1.0 and takes advantage of OS/2's ability to address up to 16 megabytes of RAM and run other applications simultaneously.

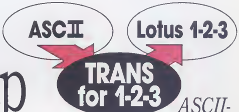
Current *Agenda* users may obtain *Agenda for OS/2* by calling Lotus at 800-345-1043. Future purchasers of the DOS version of *Agenda* will find an *Agenda for OS/2* request card in the product package. The cost in either case is $25, and the product comes with six months of Lotus Prompt support.

Agenda for OS/2 runs under OS/2 Version 1.0 on the IBM PC AT and compatibles and on PS/2 Models 50, 60, 70, and 80. It requires at least 1.5 megabytes of RAM and a hard-disk drive.

LOTUS AND DEC TEAM UP

Lotus Development Corp. and Digital Equipment Corp. have signed an agreement that calls for Lotus to develop and support applications that run under Digital's VMS operating system on DEC VAX computers. Digital will sell the applications. While Lotus did not announce what applications it plans to develop, industry observers think the major application will be a VAX version of *1-2-3*, which is not expected to be available until after *1-2-3* Release 3 for PCs ships in the second quarter of 1989.

According to a Digital spokesperson, Lotus is expected to develop both character-based software and graphical-based versions that run under *DECwindows*, Digital's graphical user interface for VMS. Digital's network software will integrate the Lotus applications into an information system that lets network users share and access data easily.



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SHORTS

PUT DATA ON THE MAP

A spreadsheet tells you how much, and a database gives you the who and what, but to find out where, you really need a map. There are currently about 50 desktop mapping programs for PCs, but you can expect to see more. Dataquest, a market research firm in San Jose, Calif., predicts the market volume will increase from $36 million in 1988 to $100 million by 1990.

These programs, such as *MapInfo* ($750, from MapInfo Corp., Troy, N.Y.) and *GeoQuery* ($349, from Odesta, Northbrook, Ill.), produce maps that range from simple outlines to multicolored, keyed, and labeled guides. They can be thematic maps, which show data characteristics superimposed over a base map, geological maps of underground resources, topographical maps, and specialized maps that display legal, administrative, or political data. City hall departments are using desktop mapping programs to keep track of tax parcels and zoning. Fire departments are using them to record the location of stored hazardous materials. Retailers are plotting their customer base, and distributors are plotting their truck routes.

Desktop mapping programs exceed the simpler map-drawing capabilities of programs such as *Lotus Freelance Plus*. These specialized mapping programs let you link data values to map locations and perform database reporting. Getting lost simply isn't a valid excuse anymore. *—Steve Rosenthal*

ADVANCED INTERFACES

Researchers are trying to narrow the gap between the way people work and the way computers work.

James Rhyne, for example, manages the Paperlike-Interface project at IBM's T. J. Watson Research Center. Rhyne and his team have developed a system that lets you enter data and commands by scrawling on a transparent tablet laid over an LCD. The tablet interprets and digitizes your pen motions as specific characters, such as letters, numbers, proofreader marks, or musical notes. The software then determines whether these characters represent commands, text, or graphic input.

At the NASA Ames Research Center, Scott Fisher directs another interface-development effort. Fisher's project is a portable computer interface that you wear on your head. Yes, on your head.

The experimental headset has two wide-angle magnifying lenses that you look through into two 3.2-inch LCDs. The display inside the headset provides depth cues the same way a stereopticon does—by showing each eye a slightly different perspective. With special voice-recognition and gesture-recognition input devices, you can control the display with a word or a gesture, stretching a document or worksheet to cover a desk or a floor or stacking several around you. Sensors in the headset detect and encode head motions. When your head moves in one direction, for example, the display moves in the opposite direction, giving you the illusion of scanning a stable landscape. Eventually, Fisher hopes to fine-tune this approach by having the headset track the movements of the wearer's cornea with a fine beam of infrared light.

For these new interfaces, researchers expect to find applications in recreational software, architectural and engineering design, training and education, and other areas. "For instance," says David Zeltzer, a professor at the Massachusetts Institute of Technology, "if a surgical instructor and his students wore [the headset] while the instructor performed a simulated operation, the students could then watch the operation through his eyes." *—Fred Hapgood*

BIG BROTHER ON DISK

How about government by floppy? The Environmental Protection Agency's Office of Underground Storage Tanks has begun to distribute its regulations on floppy disks. The pilot two-disk set, called *Reg-in-a-Box*, contains the rules and standards that affect some two million underground storage tanks at gas stations, chemical plants, dry cleaners, and factories nationwide. If the pilot effort is a success, other EPA departments will probably follow suit.

Bill Foskett, a project manager with the EPA in Washington, D.C., says the complex legal and technical vocabularies, combined with the frequent cross-references, make printed regulations extremely difficult to read. And all regulations lack an index.

The *Reg-in-a-Box* disks contain the same text as their paper counterpart, but Foskett, working with consultants, brought the information into a hypertext program called *Black Magic* (from Ntergaid, Bridgeport, Conn.), which allowed the EPA to add pop-up explanations of technical and legal terms and provide connections to cross-referenced material. The disks, in 360K, 5¼-inch format for PCs and 800K, 3½-inch format for Macintoshes, are free from the EPA while supplies last. *—S. R.*

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1-2-3 MACROS

BEYOND THE WORKSHEET

How DOS batch files and Release 2/2.01 macros can make *1-2-3* cooperate with other programs

> *I want to use a* 1-2-3 *macro or any other applicable method to run a Fortran program. The macro would control data entry into the worksheet and would then activate the Fortran program. The Fortran program would use the spreadsheet data and pass results back to the spreadsheet.*
>
> *My original Fortran program contains several thousand lines of code, which I don't want to recode as* 1-2-3 *macros. The data that the program processes will reside in two spreadsheet columns. Is what I have in mind possible?* Roger Johnson, Ann Arbor, Mich.

BY DANIEL GASTEIGER

We've encountered this question several times since *LOTUS* began. It is possible to do what you ask, but not without creating a kludge. Still, if you have a hard disk and you're willing to work through concepts in three programming environments, keep reading. We'll build a system that lets your macros interact with other software.

THE TASKS

Actually, you seem to be asking two questions. The first question is, Can a *1-2-3* macro pass control to an external program? The second question is, Can an external program and *1-2-3* exchange data?

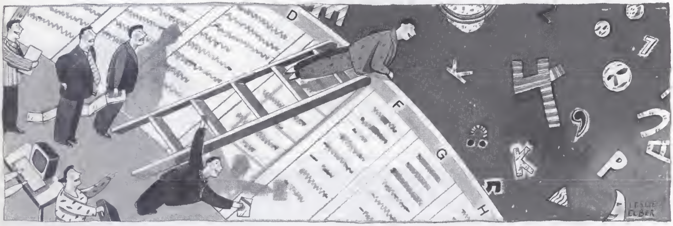
The answer to the first question is, Sort of. No macro command actually starts an external program running. You can, however, create programs that pass control from DOS to your macro, back to DOS, into an external program such as Fortran, and back to your macro.

The answer to the second question is more affirmative. For any two programs to exchange data, each program must be able to store data in a format the other can read. You'll have to modify your Fortran program so that it produces data *1-2-3* can read. But we'll see how *1-2-3* can produce data most external programs can use, and we'll see what an external program must produce to pass data to *1-2-3*.

For the balance of this discussion, we'll work with BASIC rather than Fortran because most PC users will find BASIC included in their DOS software package. The techniques should work with any programming language you can run in DOS.

FROM 1-2-3 TO BASIC AND BACK

Passing control between *1-2-3* and an external program is more involved than is passing data. Check out the Transfer Your Own Data box for an explanation of how



LESLIE COBER

to pass data from one program to another. For now, we'll focus on passing control.

The system that lets *1-2-3* pass control to an external program begins with a DOS batch file. A batch file contains a sequence of commands you might issue to DOS to perform a task. DOS processes the commands one by one, just as a macro processes commands. If one of the commands in a batch file starts a program such as *1-2-3*, the batch file lies waiting to take back control as soon as you exit from the other program.

For this example, you'll use a batch file that issues commands to rename a file from DATENT.WK1 to AUTO123.WK1. The batch file then starts *1-2-3*. Next *1-2-3* automatically retrieves AUTO123.WK1, and a macro named \0 in that file starts running when the file is in memory.

The macro accepts data entry from a user, then extracts the data to an external file. When the macro exits from *1-2-3*, the DOS batch file takes control again and runs the BASIC program. The BASIC program reads data from the file the *1-2-3* macro created, then prepares a data file for *1-2-3* to use.

When the BASIC program ends, it returns control to DOS and the batch file restarts *1-2-3*. The file named AUTO123.WK1 again loads and the macro takes control. The macro ends by exiting from *1-2-3*, whereupon the batch file renames the file from AUTO123.WK1 to DATENT.WK1.

The following batch-file commands control both the *1-2-3* and the BASIC programs. Characters shown in red represent the information that you must customize, as explained later.

```
RENAME c:\123data\datent.wk1 auto123.wk1
123
C:\BASICA SQUARES
123
RENAME c:\123data\auto123.wk1 datent.wk1
DEL c:\123data\sqrdat.prn
```

A batch file is an ASCII (text) file with a .BAT filename extension. To create this batch file, get to a DOS prompt and use DOS's CD command to make current the directory that holds your *1-2-3* program files.

Enter the command COPY CON: BONDER.BAT. Then DOS will present a blank line with the cursor at its left end. Enter the commands listed two paragraphs back. As you enter the commands, replace the path names (shown in red) in the RENAME and DEL commands with path names to the directories that contain your *1-2-3* worksheet files. For example, if *1-2-3* stores files in a subdirectory named C:\LOTUS\FILES, rewrite the first RENAME command to read:

```
RENAME c:\lotus\files\datent.wk1 auto123.wk1
```

Also note that people using non-IBM computers may not have the BASICA.COM version of BASIC. If you can't enter *basica* to start BASIC, replace *BASICA* in the third line of the batch file with the command you normally use. Be sure that a copy of the BASIC program resides in your hard disk's root directory.

Finish the list by holding down the Control key and pressing Z, then press Return. DOS will present the message *1 File(s) copied.*

To run a DOS batch file, simply enter the file name. To run this batch file, you'd type *bonder* (you don't need to type the .BAT extension) and press Return. Running the batch file now, however, would be meaningless because you haven't yet created the worksheet or the BASIC program that the batch file controls.

TRANSFER YOUR OWN DATA

When you *save* a file, *1-2-3* uses a unique format. Were you to examine the file, you'd likely find its contents unintelligible. *1-2-3*, on the other hand, knows how to interpret the data it saves and how to present the data as a spreadsheet.

When you *print* data to a file, *1-2-3* stores the data as an ASCII (text) file. When you examine the contents of such a file, they appear as familiar letters and numbers. Data in an ASCII file can have almost any arrangement. In most ASCII files, however, data fall in lines separated by end-of-line characters. Many programs that read ASCII files can recognize EOL characters as the end of a discrete datum.

In some cases, programs can store many pieces of data in a single line and can read each piece individually. When this is the case, each numeric datum is separated from the next by a comma, and each string datum is enclosed in quotation marks. This is called a comma-delimited file. The following line is typical of data in a comma-delimited file:

```
4,8,5,“null”,8,8
```

1-2-3's File Import Numbers command reads each line, from one EOL character to the next, of a comma-delimited file as a row of worksheet data. *1-2-3* reads each item from between the commas as an entry for a worksheet column.

The Print File command doesn't create a true comma-delimited file unless you prepare the data to print in advance. If you wish to include alphanumeric character strings in your print files, you must enclose label entries in quotation marks before creating the files.

Programs that deal with ASCII files generally assume that spaces between numbers delimit the data. These programs may not have as much luck recognizing discrete strings separated only by spaces. You may need to experiment with different file formats before you find one that both *1-2-3* and your external program can use.

THE DATA-ENTRY WORKSHEET

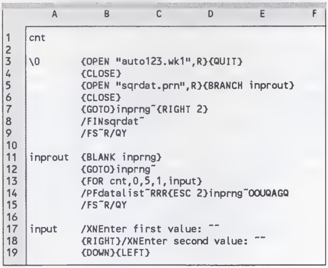
The data-entry worksheet contains a macro that automatically starts running when *1-2-3* retrieves it into RAM. At times you may wish to retrieve the worksheet manually and not have the macro take control. For those occasions the macro determines whether the file named AUTO123.WK1 resides on the disk. If the file exists, the macro continues running on the assumption that you used the batch file to start *1-2-3*. However, if AUTO123.WK1 doesn't exist, the macro stops running. Chances are you retrieved the file manually because you don't want to use the macro. This design disallows you from having a regular AUTO123 file in your data directory.

When the batch file starts *1-2-3* and loads the data-entry worksheet for the first time, the macro starts a simple data-entry routine that prompts you to enter six pairs of values in adjacent worksheet columns. When you finish entering data, the macro prints the range that contains your entries to a file called DATALIST.PRN. Then the macro saves the worksheet and exits from *1-2-3*.

When control returns to DOS, the still-running batch file takes over and issues the command BASICA SQUARES. This starts a BASIC program that calculates the sums of the squares of the data pairs that *1-2-3* stored in the file named DATALIST.PRN. The BASIC program stores its newly calculated values in the file SQRDAT.PRN, then returns control to DOS and the still-running batch file.

Once more the batch file starts *1-2-3*, and *1-2-3* retrieves the file AUTO123.WK1. When the macro starts running this time, it finds the file SQRDAT.PRN. Rather than running a data-entry routine, the macro imports the data from the SQRDAT.PRN file, saves the worksheet, and once more exits from *1-2-3*.

The following illustration shows the *1-2-3* macro that accepts data entry for use by the BASIC program. To create the macro, start in a blank *1-2-3* worksheet and enter labels in columns A and B as shown. Remember to put an apostrophe label prefix before any entry that starts with a backslash or a slash. Use the Range Name Labels Right command to assign the labels in column A as names for the adjacent cells of column B, and use the Range Name Create command to assign the name *inprng* to range A23..C28.

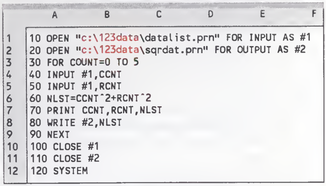


```
          A         B         C         D         E         F
 1   cnt
 2
 3   \0        {OPEN "auto123.wk1",R}{QUIT}
 4             {CLOSE}
 5             {OPEN "sqrdat.prn",R}{BRANCH inprout}
 6             {CLOSE}
 7             {GOTO}inprng~{RIGHT 2}
 8             /FINsqrdat~
 9             /FS~R/QY
10
11   inprout   {BLANK inprng}
12             {GOTO}inprng~
13             {FOR cnt,0,5,1,input}
14             /PFdatalist~RRR{ESC 2}inprng~OOUQAGQ
15             /FS~R/QY
16
17   input     /XNEnter first value: ~~
18             {RIGHT}/XNEnter second value: ~~
19             {DOWN}{LEFT}
```

The macro is ready to run, but because you've named it \0, you can't start it from within the worksheet. Also, you haven't yet created the BASIC program to which control will pass once you've used the macro to enter data. Save the worksheet with the name DATENT, then select /Worksheet Erase Yes to clear the worksheet from RAM.

THE BASIC PROGRAM

Even with no understanding of how BASIC works, you can write a BASIC program within a *1-2-3* worksheet. To create the program for this discussion, enter labels as shown, but replace the red characters with the path name to your *1-2-3* data directory.



```
          A         B         C         D         E         F
 1   10 OPEN "c:\123data\datalist.prn" FOR INPUT AS #1
 2   20 OPEN "c:\123data\sqrdat.prn" FOR OUTPUT AS #2
 3   30 FOR COUNT=0 TO 5
 4   40 INPUT #1,CCNT
 5   50 INPUT #1,RCNT
 6   60 NLST=CCNT^2+RCNT^2
 7   70 PRINT CCNT,RCNT,NLST
 8   80 WRITE #2,NLST
 9   90 NEXT
10   100 CLOSE #1
11   110 CLOSE #2
12   120 SYSTEM
```

Note that you must begin each of these labels by typing a label-prefix character, or *1-2-3* won't accept the entry. Make sure that your entries match the illustration exactly, then print the program to a file.

To print to a file, select /Print File, press Escape twice to clear the default path-name prompt, type the path name to the directory that contains your *1-2-3* program files, append the file name SQUARES.BAS to the path name, then press Return. For example, if the program files reside in a directory called C:\LOTUS, you will enter *c:\lotus\squares.bas*. Select Range and indicate A1..F12 as the range to print. Select Options Other Unformatted Quit, then select Align Go Quit. The system of programs is ready to run.

RUNNING THE BATCH FILE

To try out the system, select /Quit Yes to return to DOS. Then make current the directory that contains the *1-2-3* program files. If you need a key disk in drive A to start *1-2-3*, make sure it's there, then enter *bonder*. You won't be able to follow each step, but the batch file behaves as we've already described.

After converting the DATENT.WK1 file name to

AUTO123.WK1, the batch file starts *1-2-3*. Then *1-2-3* retrieves the renamed file, and the macro named \0 begins running. Here's what the macro does:

{OPEN "auto123.wk1",R}{QUIT} Tries to open the file AUTO123.WK1. If the file doesn't exist, control passes to the {QUIT} command and the macro stops; otherwise, control passes to the command in cell B4. AUTO123.WK1 won't exist when you manually retrieve the DATENT worksheet. This step lets the macro run only when the batch file retrieves the DATENT worksheet.

{CLOSE} Closes the AUTO123 file.

{OPEN "sqrdat.prn",R}{BRANCH inprout} Tries to open the file SQRDAT.PRN. If SQRDAT.PRN doesn't exist, control passes to the BRANCH command, which in turn passes control to the routine named *inprout*. If SQRDAT.PRN exists, control passes to the command in cell B6. The file SQRDAT.PRN won't exist before the batch file has run the BASIC program. The absence of that file shows that you haven't yet entered data into the worksheet. The macro runs its data-entry routine as follows:

{BLANK inprng} Erases the contents of *inprng*. This prepares that range to receive the data you're about to enter.

{GOTO}inprng~ Sends the cell pointer to the top-left corner of *inprng*.

{FOR cnt,0,5,1,input} Processes a FOR loop. This particular {FOR} command causes *1-2-3* to process the commands of the routine named *input* six times. First, those commands prompt you to enter a value. Then they move the cell pointer to the right, prompt you to enter a second value, and move the cell pointer down and to the left. The result of the FOR loop is that you enter six values in column A and six values in column B of the range named *inprng*.

/PFdatalist~RRR{ESC 2}inprng~OOUQAGQ Prints the contents of *inprng* to the file DATALIST.PRN. The macro selects Options Other Unformatted from the Print menu, so *1-2-3* will print the range without margins or page breaks. This creates an ASCII file with two values separated by spaces on each line. External programs that can retrieve ASCII files should treat DATALIST as a comma-delimited file. That is, most programs will interpret the spacing between values in DATALIST as commas and will recognize each value as a discrete datum.

/FS~R/QY Saves the worksheet file to preserve the data you've entered, then exits from *1-2-3*.

When the batch file regains control, it immediately activates the BASIC program you created earlier. That program reads the data from the file DATALIST.PRN, performs some calculations with the data, and uses the results of the calculations to create a new file called SQRDAT.PRN.

The BASIC program returns control to the batch file, which in turn restarts *1-2-3*. Once more, *1-2-3* retrieves the file AUTO123.WK1 and runs the macro named \0.

This time around, the macro runs a little differently:

{OPEN "auto123.wk1",R}{QUIT} Determines that the file AUTO123.WK1 exists and so lets control pass to the command in cell B4.

{CLOSE} Closes the file AUTO123.WK1.

{OPEN "sqrdat.prn",R}{BRANCH inprout} Determines that the file SQRDAT.PRN exists and so lets control pass to the command in cell B6. SQRDAT.PRN is the file the BASIC program created only moments before.

{CLOSE} Closes the file SQRDAT.PRN.

{GOTO}inprng~{RIGHT 2} Moves the cell pointer to the top of the third column of the range named *inprng*.

/FINsqrdat~ Selects /File Import Numbers and indicates the file SQRDAT.PRN. This copies into the worksheet the data that the BASIC program created.

/FS~R/QY Saves the file with both the data you entered earlier and the data the BASIC program generated, then exits from *1-2-3*.

When the batch file takes control for the last time, it renames the AUTO123 file to DATENT.WK1. This will prevent *1-2-3* from automatically retrieving that file the next time you use the program. The batch file also erases the file SQRDAT.PRN, so you'll be able to run the system of programs in its entirety in the future. The program leaves you at the DOS prompt in the directory that holds your *1-2-3* system files.

PASSING CONTROL IN GENERAL

If things don't happen properly when you first run these programs, don't panic. First compare your efforts with our instructions. If you're certain there are no errors but things still don't work, perhaps an add-in program is hanging you up. Eliminate any add-ins you normally attach, then try the system again.

We've presented a complex collection of programs to illustrate a fairly simple concept: A DOS batch file can pass control from *1-2-3* to an external program and back. The macros you write determine what happens within *1-2-3*. Likewise, the code of the external program determines what happens there.

In creating the macros and the external programs, you should anticipate the events surrounding their use. The macro we've shown behaves differently, depending on whether it was started manually or by a batch file. You might build the same type of mechanism into an external program. ■

Send Us Your Macros

If you have questions about macros, send them to us. If you have a favorite macro technique, we'd like to see it. If we use your letter in a column, we'll send you $25. Write to: Macros Editor, LOTUS *Magazine, P.O. Box 9123, Cambridge, MA 02139–9123.*

A DATA-CONVERSION TOOL

Let the @INDEX function and the {PUT} command manage information stored in tables.

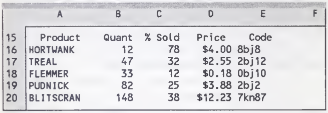
BY DANIEL GASTEIGER

When you work in a *Symphony* spreadsheet, your data usually ends up in a table. Once you've created a table with several columns and rows of data, manipulating the data can be a chore. For example, suppose you enter a column of integers that represent percentages. Later you wish those values to be displayed in a percent format. To calculate the percentages so that *Symphony* displays them correctly, you need to divide each entry in the column by 100. Or suppose that one column of a large table contains people's names entered with uppercase letters and you prefer to see the names with only their first letters capitalized.

For small tables, you can make these changes in a few moments by entering and copying a formula in the worksheet. For large tables, however, you should use a macro to update whole columns or rows of entries.

QUICK-AND-DIRTY UPDATES

Column C of the table in the following worksheet contains integers that represent percentages. Before *Symphony*'s Percent format will display the values correctly, you must convert the integers to decimal values.



	A	B	C	D	E	F
15	Product	Quant	% Sold	Price	Code	
16	HORTWANK	12	78	$4.00	8bj8	
17	TREAL	47	32	$2.55	2bj12	
18	FLEMMER	33	12	$0.18	0bj10	
19	PUDNICK	82	25	$3.88	2bj2	
20	BLITSCRAN	148	38	$12.23	7kn87	

We'll use this table to illustrate several techniques discussed in this article. To create the table, enter labels and values as shown. Note that the labels in row 15 are centered and that range D16..D20 has a currency format with two decimal places. Columns A, B, and C have widths of 12, 7, and 8 characters, respectively.

Since not much is going on in the worksheet, it's most efficient to simply write and copy a formula that calculates the decimal values.

Start in a blank column, or insert a column to the left of column C. To insert a column, place the cell pointer on any cell within column C, select MENU Insert Column, and press Return. Move the cell pointer to the second row of the new column, cell C16, and enter the formula +D16/100.

Copy cell C16 to range C17..C20: With the cell pointer in cell C16, select MENU Copy, press Return, and indicate range C17..C20. Then select MENU Range Values, and specify range C16..C20 as the From range and cell D16 as the To range. Finally, delete column C from the worksheet by selecting MENU Delete Column and indicating column C. Now you can use the MENU Format % command to assign a format to the entries in column C.

With practice, using this technique to convert columns of data from one form to another becomes second nature. Unfortunately, this type of conversion is cumbersome when you're dealing with large worksheets. That's when you should use a macro.

DATA CONVERSION IN LARGE WORKSHEETS

If your worksheet data occupy tens of columns and hundreds or thousands of rows and if they are laden with formulas, inserting and deleting columns can take a long time. Also, a long column of formulas can take several minutes to recalculate. These conditions make

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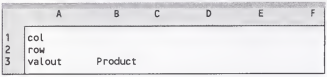
"Macro Letters" was prepared by Macros Assistant Editor Nicholas Delonas.

LESLIE COBER

the quick-and-dirty data-conversion technique not so quick anymore.

By combining the @INDEX function with the {PUT} macro command, you can create a short macro that automates data-conversion chores, handling them more efficiently than you could manually. We'll create the macro, and as we do, we'll examine some of the macro's components to understand how it works.

Start with the worksheet described earlier and enter labels in cells A1 through A3 as shown below:



```
        A          B        C          D          E          F
1   col
2   row
3   valout     Product
```

Use the Range Name Labels Right command to assign the labels in range A1..A3 as names for the adjacent cells of column B. Use the Range Name Create command to assign the name *table* to range A15..E20. Finally, enter the formula @INDEX(table,col,row) in the cell named *valout* (B3). The formula should return the label *Product* as shown in the illustration.

The cells you just labeled and named play an important part in the data-conversion macro we're building. The macro will use these cells to return information from the table.

To see how this works, enter the number 1 in the cell named *row*. The cell named *valout* is immediately updated to return the label *HORTWANK*. Enter the number 2 in the cell named *row*, and the formula returns *TREAL*. In fact, the @INDEX formula in *valout* can return any label or value stored in the range named *table*.

THE @INDEX FUNCTION

As mentioned, the @INDEX function has the syntax @INDEX(*table,col,row*). The argument *table* identifies a range from which the function should return a value. In our worksheet, *table* is range A15..E20. The arguments *col* and *row* identify, within the range *table*, the location of the cell whose value the function should return.

The *col* and *row* arguments of the @INDEX function identify a cell by its location relative to the top-left corner of *table*. In our worksheet, when *col* is 1, the @INDEX function returns a value from column B of *table* because column B is one column to the right of the table's first column. Likewise, when *row* is 2, the @INDEX function returns a value from row 17 of the table—the row that is two rows down from the table's top row. The formula @INDEX(table,0,0) returns the value from the top-left cell of *table*, that is, the cell zero columns to the right and zero rows down from the top-left corner.

In our worksheet, when you change the values of the cells named *col* and *row*, you're changing the values of the @INDEX formula's *col* and *row* arguments. The macro we build will change the value of *row* repeatedly, and with each change, the macro will convert one value in the table.

CHANGING A VALUE

So far we've created a mechanism that returns values from the table. To capitalize on that mechanism, the macro will need to use those values in calculations, then place the results of the calculations back into the table.

Performing a calculation is easy. Enter the label *valin* into cell A4 at the end of the list of labels in column A. Assign *valin* as the name for cell B4, then in cell B4 enter the formula @PROPER(valout). Finally, make sure that the cell named *col* is blank, and enter the number 1 in the cell named *row*.

The label *HORTWANK* appears in the cell named *valout*, and the label *Hortwank* appears directly beneath it in the cell named *valin*. The @INDEX formula in *valout* is returning the value that is zero columns to the right and one row down from the top-left cell in *table*. That cell contains the label *HORTWANK*. The @PROPER formula in *valin* returns a label that represents the one in *valout*, but with the first letter capitalized and the remaining letters set in lowercase.

The macro we write will perform this conversion on every entry in the *Product* column of the table. The macro will increase the value of *row*, recalculate the formulas in *valout* and *valin*, then use a {PUT} command to place the result of the *valin* calculation back into the range named *table*.

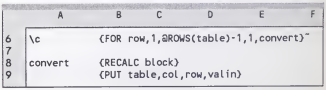
THE {PUT} COMMAND

The {PUT} command's syntax is similar to that of the @INDEX function:

{PUT *table,col,row,value*}

When a macro processes this {PUT} command, it locates the cell that is *col* columns to the right and *row* rows down from the top-left cell in *table*. It then places *value* into that cell. In effect, this is the reverse of the operation of the @INDEX function.

Our macro will exploit the similarity of the syntaxes of the @INDEX function and the {PUT} command by using the cells *col* and *row* as arguments in a {PUT} statement. When the @INDEX function returns an entry from a cell whose offset, or displacement, in *table* is *col* and *row*, the {PUT} command will place a value back into that same cell. The following illustration shows a macro that converts all of the entries in the *Product* column of the table:



```
           A          B        C          D          E         F
6   \c               {FOR row,1,@ROWS(table)-1,1,convert}~
7
8   convert          {RECALC block}
9                    {PUT table,col,row,valin}
```

To create the macro, enter labels as shown, and assign the labels in range A6..A8 as names for the adjacent cells of column B. Then assign the name *block* to the range B1..B4.

To try out the macro, watch the entries in column A of the table, then hold down the MACRO key (Alt on most computers) and press C. The labels transform almost instantly. Here's what the macro does:

{FOR row,1,@ROWS(table)−1,1,convert}~ Runs a FOR loop, a collection of commands that *Symphony* processes repeatedly. The {FOR} command has five arguments. The first argument, *row* in this case, identifies a cell that *Symphony* uses to keep track of how many times the loop is processed. On the loop's first pass, *Symphony* stores the value of the command's second argument, 1, in *row*. On each subsequent pass of the loop, *Symphony* increases the value of *row* by the command's fourth argument, which is also 1. With each increase in the value of *row*, *Symphony* compares the value of *row* with the value of the command's third argument. If the third argument is the greater value, *Symphony* processes the routine named in the {FOR} command's fifth argument, *convert*. When the value of *row* exceeds the value of @ROWS(table)−1, the FOR loop ends, and macro control passes to the next available command. The expression @ROWS(table)−1 returns a number that is one less than the total number of rows in *table*. With each pass of the loop, *Symphony* processes the commands that follow.

{RECALC block} Recalculates the formulas in the range named *block*. Remember that the {FOR} command has just increased the value of *row* by 1. This {RECALC} command ensures that both the @INDEX formula that refers to *row* and the conversion formula are current.

{PUT table,col,row,valin} Places the new value of *valin* into the table at the current column and row offset.

When the {FOR} loop finishes processing, the macro presses Return to update the worksheet. At that moment, the converted values appear in the table, and the formulas in *valout* and *valin* return ERR. The ERRs aren't important. They result because the @INDEX function's *row* argument is now 6, and you can count only five rows from the top row of *table* before you go outside the range.

MODIFYING THE MACRO

By making only two changes, you can prepare this macro to convert data in any column of the range named *table*. For example, suppose you wish to increase every price in column D by 7%. Column D is three columns to the right of column A, so enter *3* in the cell named *col*. The next time you run the macro, it will modify entries in this new column.

If it bothers you to see ERRs in *valout* and *valin*, enter *1* in *row*. Then enter the formula +valout*1.07 in the cell named *valin*. Run the macro. *Symphony* updates the values in the *Price* column of *table*. Again, the ERRs that appear after the macro runs don't affect its future performance.

Try one more conversion. Change the value in *col* to 4. This will make the macro work on the *Code* column of the table. Again, enter *1* in *row*, then enter the formula @STRING(row,0)&"RR" in the cell named *valin*. When you run the macro, *Symphony* makes a new entry into each cell of the *Code* column.

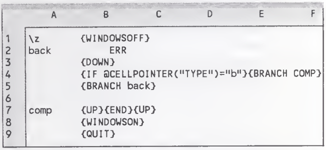
This macro is rocket fast in a small worksheet, and it works at a good clip in large worksheets as well. Your greatest payoff will come with medium-size tables in enormous worksheets. Play around a little more with this model, then create a few of your own. In upcoming issues we'll look at other applications that get added zip from the @INDEX function and the {PUT} command.

MACRO LETTERS

MEMORY MYSTERY

I use *Symphony* Release 1.2 to download large files. I then use the @VALUE function and the Range Values command to convert the data from labels to values. The problem is that the resulting numbers use more than twice the amount of RAM than do the values that the Query Parse command produces.

I don't like the Query Parse method, nor do I like giving up that much RAM, so I use the following macro, which changes a column of labels to values while saving on memory:



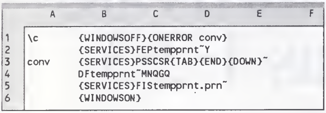
```
           A          B          C          D          E          F
1    \z         {WINDOWSOFF}
2    back            ERR
3               {DOWN}
4               {IF @CELLPOINTER("TYPE")="b"}{BRANCH COMP}
5               {BRANCH back}
6
7    comp       {UP}{END}{UP}
8               {WINDOWSON}
9               {QUIT}
```

To create the macro, enter labels as shown. Enter the formula @TRIM(@CELLPOINTER("contents")) in cell B2. Use the Range Name Labels Right command to assign the labels in column A as names for the adjacent cells of column B.

To run the macro, make sure the worksheet is set to automatic recalculation. Move the cell pointer to the first cell in the column of labels you want to convert, then press MACRO-Z. The macro converts a column of labels to values, one label at a time—a slow process. If you know a better way to reduce memory loss after label conversion, please let me know.

Patrick Flanagan
Vallejo, Calif.

The editor replies: Apparently, *Symphony* maintains information about a formula even after you've converted it to a value. You'll reduce memory loss by using a conversion technique that foregoes the formula altogether. Try using the following macro:



```
         A         B          C          D          E          F
1   \c        {WINDOWSOFF}{ONERROR conv}
2             {SERVICES}FEPtempprnt~Y
3   conv      {SERVICES}PSSCSR{TAB}{END}{DOWN}~
4             DFtempprnt~MNQGQ
5             {SERVICES}FIStempprnt.prn~
6             {WINDOWSON}
```

To create the macro, enter labels as shown, and assign the labels in column A as names for the adjacent cells of column B. To run the macro, place the cell pointer in the first cell of the column you wish to convert. Then hold down the MACRO key and press C. Here's what the macro does:

{WINDOWSOFF}{ONERROR conv} Freezes the screen in order to decrease the macro's run time, then begins error trapping. From this point, if an error arises, macro control shifts to the routine named *conv*.

{SERVICES}FEPtempprnt~Y Erases the file named TEMPPRNT.PRN if it exists. If the file doesn't exist, an error ensues, and macro control passes to *conv*.

{SERVICES}PSSCSR{TAB}{END}{DOWN}~ Assigns the column of labels as the print Source range. Note that the Print range will include entries only down to the first blank cell in the column.

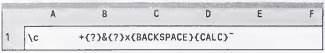
DFtempprnt~MNQGQ Sets TEMPPRNT.PRN as the name of the print file. The macro then elects to print without margins or page breaks and prints the column of labels to the file.

{SERVICES}FIStempprnt.prn~ Uses the File Import Structured command to combine the file named TEMPPRNT.PRN into the worksheet. The imported file overwrites the original labels with numeric values.

{WINDOWSON} Updates the display.

COMBINING LABELS

I often like to concatenate labels created in Learn mode. To speed things up, I use the following macro to merge two labels.



```
         A         B          C          D          E          F
1   \c         +{?}&{?}x{BACKSPACE}{CALC}~
```

To create the macro, enter labels as shown, beginning each entry with a label prefix character. Then use the Range Name Labels Right command to assign the name \c to cell B1.

To run the macro, hold down the MACRO key (Alt on most computers) and press C. The macro types a plus sign and waits for you to point to the cell that contains the first label. Highlight the cell and press Return. At this point the edit line in the control panel displays a formula that refers to a single cell.

The macro continues to build the formula by typing an ampersand. The macro pauses again so that you can indicate the second of the labels to concatenate. When you press Return, the macro adds the second cell's address to the formula on the edit line.

The macro now types an X and presses Backspace CALC to change the new string formula into a label. Finally, the macro presses Return to enter the concatenated labels in the cell that contained the cell pointer when you started the macro.

Vernon J. Robert
New Orleans, La.

MANAGING THE MACRO MANAGER

I use the *Symphony* Macro Library Manager add-in (MACROMGR.APP) and have become adept with the Load, Save, Edit, Remove, and Name-List procedures. However, I can't figure out how to delete a macro library permanently. What's the secret?

L. D. Bender
Martinez, Ga.

The editor replies: The Macro Library Manager stores libraries as files with .MLB extensions. With the Library Manager attached, select SERVICES File Erase Macro-Library to delete a macro-library file. ■

Some Useful Conventions

Our examples use uppercase letters for macro commands and lowercase letters for range names and addresses used by macros ({BRANCH input}). Whenever possible, range names appear to the left of the named cells. This helps to identify named cells. Remember, when you enter macro steps that start with a slash (/), a label-prefix character such as backslash (\), or any arithmetic operators (+, −, *, etc.), place an apostrophe (') before the entry or you may get unexpected results.

Why Use Range Names?

When you type a command as a label, cell references within the command are meaningless to *Symphony* until it processes the macro. For example, if your macro uses the command {MENU}Cb3~h20~ to copy information from a table and you move the table to another part of the worksheet, your macro no longer copies the proper information. If, however, the cells are named *source* and *destination* and the macro command is {MENU}Csource~destination~, moving the table containing these cells does not adversely affect the macro. If while writing a macro you need to rearrange your worksheet, you'll be much happier if you've used range names instead of cell references in your macro code. —*D. G.*

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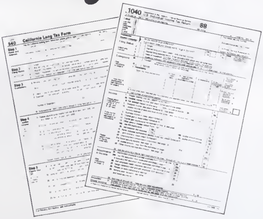

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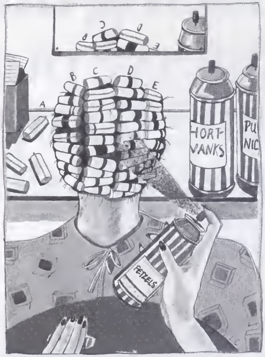
MACRO BASICS

SET TITLES IN 1-2-3

Your first macro can help you set and clear worksheet titles.

BY PAULA DEMPSEY



Setting worksheet titles locks selected rows and columns into the display on your screen. Once you set titles, you can move the cell pointer to any point on the worksheet and still view the rows or columns that you included in the titles area.

In a *1-2-3* database, for example, you might set titles to freeze the field names at the top of the display. This reveals each field's identity, even when the first few records have scrolled off the screen.

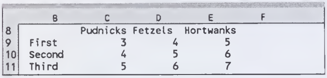
There is one disadvantage to setting worksheet titles—with titles set, it's difficult to move the cell pointer into the titles area. And when the cell pointer is in the titles area, *1-2-3* often displays two copies of the cells in that area.

Ideally, when you wish to access cells in the titles area, you should clear the titles first, then reset them when you wish to work further in the rest of the worksheet. Setting and clearing worksheet titles is busywork that's well suited to be done by macros.

SETTING TITLES

A macro is simply a list of instructions that *1-2-3* follows automatically. When you start a macro, it types, moves the cell pointer, and accesses menus as you would if you were performing a task manually.

Let's create a small worksheet and use it to demonstrate how easy writing macros can be. Start with a blank worksheet and enter labels and numbers as shown in the figure below left (a more realistic application might contain several hundred rows of data).



```
        B          C         D         E          F
 8              Pudnicks Fetzels  Hortwanks
 9  First            3        4         5
10  Second           4        5         6
11  Third            5        6         7
```

When you finish entering the data, press the PageDown key. With the block of labels and values off-screen, it's suddenly difficult to identify which column is labeled *Pudnicks*, which is labeled *Fetzels*, and which is labeled *Hortwanks*. Press PageUp to return to the work area and move the cell pointer to row 9. Press slash and select Worksheet Titles Horizontal.

1-2-3 returns to Ready mode with no apparent change to the worksheet. However, when you press PageDown, the labels *Pudnicks, Fetzels*, and *Hortwanks* remain visible in cells C8, D8, and E8, respectively. When you press the Home key, the cell pointer jumps to cell A9 rather than to cell A1. And when you press UpArrow, the cell pointer refuses to move above row 9.

To clear the titles and allow free movement of the cell pointer, select /Worksheet Titles Clear.

AUTOMATIC TITLES

Setting and clearing titles manually isn't a big chore, but if you have to do it constantly, it's tiresome. Let's write a macro to make it a little easier. In the current worksheet, enter labels as shown in the illustration at the top of the next column. Note that you must precede each entry with an apostrophe label prefix or you'll get unexpected results.

Assign the labels \t and \c in Column A as range names for cells B1 and B3, respectively. To do this, press slash, select Range Name Labels Right, and indicate range A1..A3. You have just created two macros and

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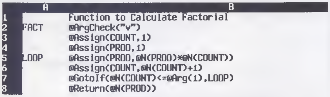

```
          A                B
1               Function to Calculate Factorial
2   FACT        @ArgCheck("v")
3               @Assign(COUNT,1)
4               @Assign(PROD,1)
5   LOOP        @Assign(PROD,@N(PROD)*@N(COUNT))
6               @Assign(COUNT,@N(COUNT)+1)
7               @GotoIf(@N(COUNT)<=@Arg(1),LOOP)
8               @Return(@N(PROD))
```

3-2-1 GOSUB turns any named range into a subroutine, written entirely in 1-2-3 formulas. @ARG and @RETURN accept and return numbers, strings and ranges. @ASSIGN updates cell variables, and @INDEX accesses worksheet arrays. @GOTOIF lets you create branching and looping programs.

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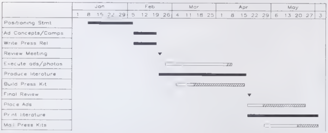

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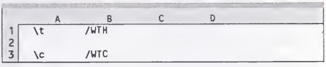

```
     A         B         C         D
1   \t        /WTH
2
3   \c        /WTC
```

given them names that allow you to run them.

As stated earlier, macros are collections of instructions that *1-2-3* follows automatically. You store macro instructions as labels in the worksheet. At their simplest, macro instructions represent the keys you would press to perform a task manually.

You name macros in order to identify them to the macro processor. *1-2-3*'s macro processor recognizes any single letter preceded by a backslash (\) as a macro name. Think of the macro processor as something that takes your place at the keyboard. When you identify a macro to the macro processor, the processor follows the instructions the macro contains.

THINK OF THE MACRO PROCESSOR AS SOMETHING THAT TAKES YOUR PLACE AT THE KEYBOARD.

Try one. Move the cell pointer to cell B9. Now hold down the MACRO key (Alt on most computers) and press T. This tells *1-2-3* to run the macro named *\t*. The macro processor follows the instructions stored in cell B1; it presses slash and selects Worksheet Titles Horizontal. This happens so quickly that you may not notice, but now the cell pointer will refuse to move above row 9 of the worksheet; the worksheet titles are locked onscreen.

When you wish to clear titles and gain access to the top rows of the worksheet, simply hold down the MACRO key and press C. The macro processor presses slash and selects Worksheet Titles Clear.

ON YOUR OWN

The two macros we've created for this discussion perform very simple tasks. Yet those tasks might arise many times during a single work session. The point is, with very little effort you can create macros to automate almost any spreadsheet task.

When you develop your own macros, follow these steps: Create a label that contains a representation of every key you press to perform a task. Assign a macro name to the cell holding that label. When you want the macro to take control, hold down the MACRO key and press the letter of the macro's name. ■

Paula Dempsey is a technical writer at Lotus Development Corp.

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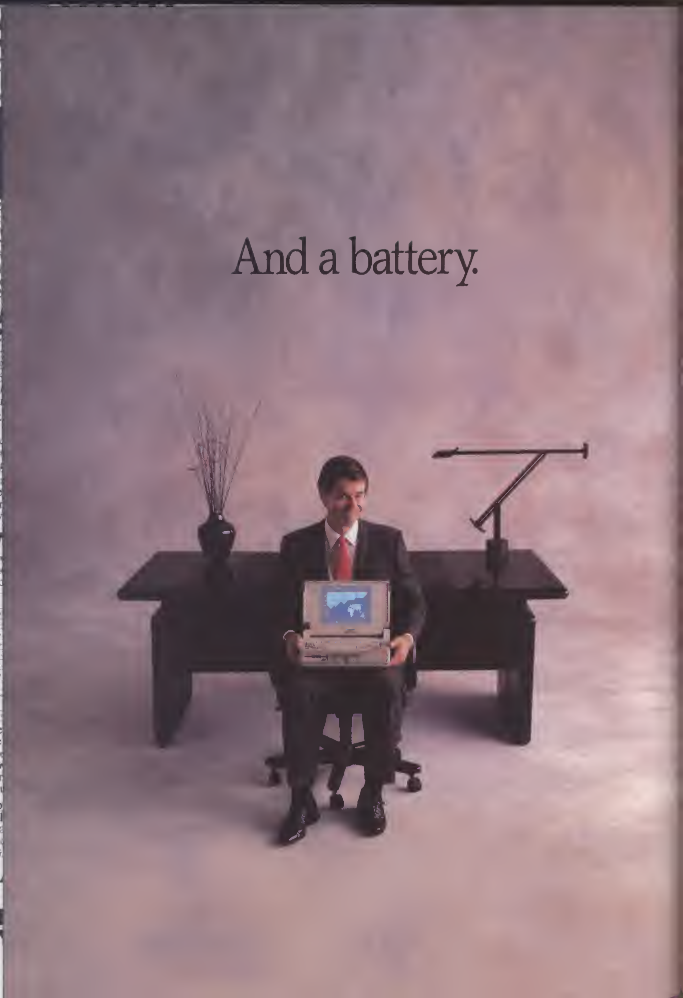
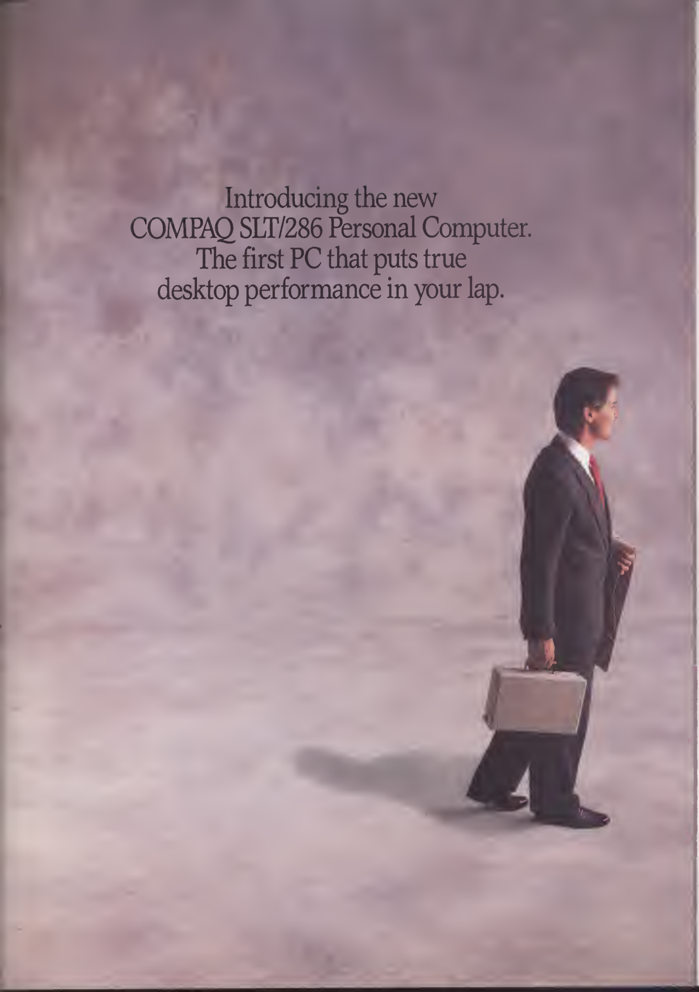

And a battery.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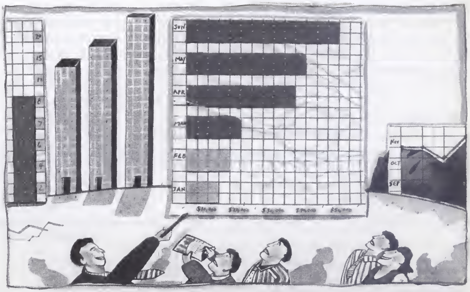
ACCOUNTING

SPOT TRENDS WITH MINI GRAPHS

Reveal performance trends by using string functions to create charts in your worksheet.

BY CHARLES W. KYD



In ancient times, advisors to kings and generals looked at tea leaves, the stars, and even animal entrails in hopes of seeing future dangers. Today, advisors to businesspeople turn to *t* distributions and curvilinear regressions to see what lies ahead. Many of us find the trappings of statistics just as inscrutable as chicken innards.

For all its complex terminology and methods, statistics is essentially a means for analyzing the past to help project the future. Often, a simple graph can indicate upcoming problems.

Using *1-2-3* Release 2/2.01 or *Symphony*, you can devise a model that computes performance ratios and graphs them right on the spreadsheet. You can print the report, including graphs, directly from your spreadsheet—without using the PrintGraph program.

Figure 1 shows a report with mini graphs of both the current and debt-to-equity ratios of a hypothetical company for each month of 1988. The actual ratios appear in column C and are the results of @VLOOKUP formulas. Each formula looks up the date to its immediate left in a table of historical data shown in figure 2 and returns the corresponding ratio.

This firm gauges its performance by comparing its actual ratios with an objective standard. Here, the objective standard is the data from the Robert Morris Associates (RMA) *Annual Statement Studies*. This annual publication presents median and quartile financial ratios for each year by industry for roughly 400 industries. The publication is important to many businesses because banks often use it for evaluating loan applications. In figure 1 the ratios from the RMA report appear in column D. You may also use as a standard the figures published by Dun and Bradstreet or your industry's trade association. The comments in column E are the results of @VLOOKUP formulas and indicate the firm's performance as compared with the RMA values.

The graphs make it easier to see if the actual ratios reveal any trends. The values in column L are required by the string-returning formulas that produce the graphs, but they are not of interest to the people who read the report. Even though they appear in the figure, you'd only include columns A through I when printing the report.

Figure 2 contains historical financial data, RMA data, and some other values required by the formulas in figure 1. You enter both the performance ratios and the RMA ratios into the spreadsheet. Note that the RMA ratios are hypothetical. Your banker or library can provide the RMA ratios for your industry.

The entries in range S35..T39 control the comments that appear in ranges E6..E17 and E23..E34 of figure 1. If the actual ratio in any month is more than 20% lower than the RMA ratio, the comment for that month will be the word *Terrible*. If the actual ratio is between 10% and 20% lower than the RMA ratio, that month's com-

---

Charles W. Kyd is the author of Financial Modeling Using 1-2-3 *(Osborne/McGraw-Hill, 1986) and a consultant in Seattle.*

LESLIE COBER

ment will be the word *Poor*, and so on.

The entry in cell T41 is the width, in characters, of the graphs. You can change this value to make the graphs wider or narrower. Cell T42 contains a string-returning formula whose result is used as an argument by the formulas that make up the graphs.

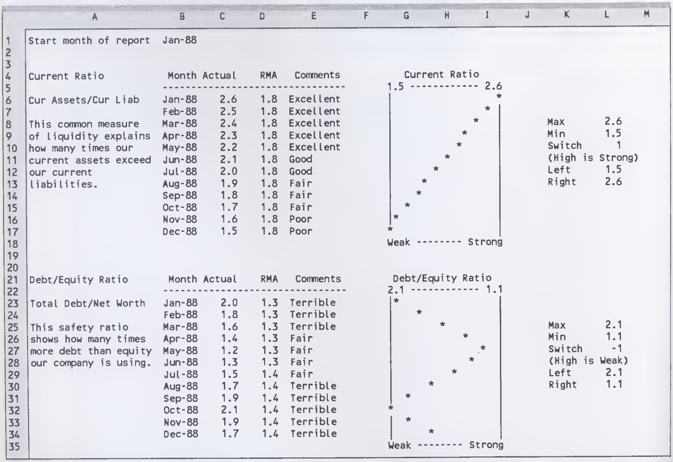
Build this worksheet using the instructions in the box on pages 36 and 37.

HOW IT WORKS

The paragraphs that follow will help you understand the worksheet by explaining its formulas.

The date that you enter in cell B1 is the starting month for the report. Cells B6 and B23 repeat the date that is in cell B1. Ranges B7..B17 and B24..B34 return the serial values for the first day of each of the next 11 months. If you want to see a report for any 12-month period for which the spreadsheet contains historical data, simply enter the desired month in cell B1 as @DATE(*year*,*month*,1) and press the CALC key. In our example, there is historical data going back to January 1987, so the entry in cell B1 could represent the first day of any month back to January 1987.

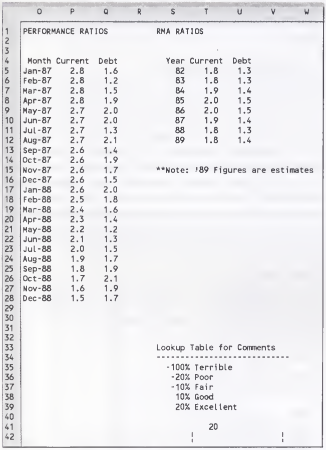
As mentioned earlier, column C contains two ranges of @VLOOKUP formulas that find the values from the range *ratios* that correspond to the dates in the cells to their left. Column D also contains @VLOOKUP formulas, but there is a difference. The table of RMA data contains one value for each year instead of one for each month. These lookup formulas start by determining the year values of the corresponding dates in column B. However, RMA values for the industry to which this company belongs are based on a fiscal year that begins in July. Therefore, each RMA formula adds 1 to the year number if the month on its row is greater than 6. It does this by adding a logical expression—an expression that equals 1 when true and 0 when false—to the year value. In the example, the formulas in range D6..D11 look up the RMA current-ratio value for fiscal year 1988, and the formulas in range D12..D17 look up the RMA value for fiscal year 1989. Note that in this scenario, the RMA value for 1989 is a guess. Assume that you're producing this report early in calendar year 1989. The RMA values for fiscal 1989 are not available yet, so you've entered some guesses in cells T12 and U12 and noted that fact with the entry in cell S15. When the RMA values are available, you'll enter them and erase the message.



```
                 A                  B      C     D       E        F      G     H     I     J     K      L      M

1  Start month of report  Jan-88
2
3
4  Current Ratio           Month Actual    RMA   Comments             Current Ratio
5                         --------------------------------        1.5 ----------- 2.6
6  Cur Assets/Cur Liab    Jan-88    2.6    1.8  Excellent        |                  *
7                         Feb-88    2.5    1.8  Excellent        |                * |
8  This common measure    Mar-88    2.4    1.8  Excellent        |              *   |       Max       2.6
9  of liquidity explains  Apr-88    2.3    1.8  Excellent        |            *     |       Min       1.5
10 how many times our     May-88    2.2    1.8  Excellent        |           *      |       Switch      1
11 current assets exceed  Jun-88    2.1    1.8  Good             |         *        |       (High is Strong)
12 our current            Jul-88    2.0    1.8  Good             |       *          |       Left      1.5
13 liabilities.           Aug-88    1.9    1.8  Fair             |     *            |       Right     2.6
14                        Sep-88    1.8    1.8  Fair             |    *             |
15                        Oct-88    1.7    1.8  Fair             |  *               |
16                        Nov-88    1.6    1.8  Poor             |*                 |
17                        Dec-88    1.5    1.8  Poor             *                  |
18                                                               Weak -------- Strong
19
20
21 Debt/Equity Ratio       Month Actual    RMA   Comments         Debt/Equity Ratio
22                        --------------------------------        2.1 ----------- 1.1
23 Total Debt/Net Worth   Jan-88    2.0    1.3  Terrible         |*                 |
24                        Feb-88    1.8    1.3  Terrible         |    *             |
25 This safety ratio      Mar-88    1.6    1.3  Terrible         |        *         |       Max       2.1
26 shows how many times   Apr-88    1.4    1.3  Fair             |            *     |       Min       1.1
27 more debt than equity  May-88    1.2    1.3  Fair             |              .*  |       Switch     -1
28 our company is using.  Jun-88    1.3    1.3  Fair             |             *    |       (High is Weak)
29                        Jul-88    1.5    1.4  Fair             |          *       |       Left      2.1
30                        Aug-88    1.7    1.4  Terrible         |      *           |       Right     1.1
31                        Sep-88    1.9    1.4  Terrible         |  *               |
32                        Oct-88    2.1    1.4  Terrible         *                  |
33                        Nov-88    1.9    1.4  Terrible         |  *               |
34                        Dec-88    1.7    1.4  Terrible         |      *           |
35                                                               Weak -------- Strong
```

FIGURE 1. This area of the worksheet is a report of asset-to-liability and debt-to-equity ratios for 1988. The report compares the hypothetical firm's actual ratios (column C) to an objective standard ratio for the firm's industry (column D). The objective standard is published by Robert Morris Associates (RMA). The words in the *Comments* column are the results of @VLOOKUP formulas and describe how the company's performance compares with the RMA standard. The graphs, which are created using string-returning formulas, visually represent the company's actual performance.



```
        O       P       Q       R       S       T       U       V       W
 1  PERFORMANCE RATIOS          RMA RATIOS
 2
 3
 4   Month Current   Debt         Year Current   Debt
 5  Jan-87    2.8     1.6           82     1.8    1.3
 6  Feb-87    2.8     1.2           83     1.8    1.3
 7  Mar-87    2.8     1.5           84     1.9    1.4
 8  Apr-87    2.8     1.9           85     2.0    1.5
 9  May-87    2.7     2.0           86     2.0    1.5
10  Jun-87    2.7     2.0           87     1.9    1.4
11  Jul-87    2.7     1.3           88     1.8    1.3
12  Aug-87    2.7     2.1           89     1.8    1.4
13  Sep-87    2.6     1.4
14  Oct-87    2.6     1.9
15  Nov-87    2.6     1.7       **Note: '89 Figures are estimates
16  Dec-87    2.6     1.5
17  Jan-88    2.6     2.0
18  Feb-88    2.5     1.8
19  Mar-88    2.4     1.6
20  Apr-88    2.3     1.4
21  May-88    2.2     1.2
22  Jun-88    2.1     1.3
23  Jul-88    2.0     1.5
24  Aug-88    1.9     1.7
25  Sep-88    1.8     1.9
26  Oct-88    1.7     2.1
27  Nov-88    1.6     1.9
28  Dec-88    1.5     1.7
29
30
31
32
33                              Lookup Table for Comments
34                              ----------------------------
35                                -100% Terrible
36                                 -20% Poor
37                                 -10% Fair
38                                  10% Good
39                                  20% Excellent
40
41                                          20
42                                      ¦                  ¦
```

FIGURE 2. This part of the worksheet contains historical data, the lookup table for the *Comments* column, and two additional values (cells T41 and T42) required by the formulas in figure 1.

Each formula in the *Comments* column divides the actual value by the RMA value and subtracts 1. This result represents the percentage by which the actual value is above or below the RMA. From the range *comments*, the formula looks up the label that corresponds to this value. With some performance ratios, lower values mean that your firm is in a stronger position. In the case of the debt-to-equity ratio, having an actual value below the RMA is good or excellent, not poor or terrible. The actual-to-RMA ratios in these formulas in the debt-to-equity section are multiplied by the value in cell L27, next to the label *Switch*. Whenever the switch value is −1, the sign of the ratio is reversed. The string-returning formulas in cells K11 and K28 remind you of the assumption behind the values you entered in the switch cells.

The formulas in column G are string-returning formulas. The one thing they have in common is using the cell named *scale* as an argument. If you change the value of cell T41 from 20 to 25 and then press the CALC key, the graphs will widen, the asterisks will retain their relative distance from each other and from the borders, and the titles will remain centered. The value of *scale* controls where characters are placed or how many times characters are repeated. For the sake of clarity, let's look at the formulas for the *Current Ratio* graph, range G4..G18 in figure 1.

Cell G4 repeats the label in cell A4 and centers it over the graph by adding some spaces at the beginning of the label. The number of added spaces is dependent on the length of the label in cell A4 and the value of *scale*. Cell G5 converts the values in cells L12 and L13 to strings and separates the strings with spaces and eight fewer hyphens than the value of *scale*.

The formulas in range G6..G17 create the graph. They use the @REPLACE function, which takes four arguments: a string in which to replace characters, the location of the first character to remove, the number of characters to remove, and the characters to use in place of removed characters. Here, the string from which to replace characters is the string in cell T42 (*frame*). Cell T42 contains another string-returning formula that returns a split vertical bar (¦), two fewer spaces than the value of *scale*, and another split vertical bar. Returning to our graph formulas, the position at which to start replacing characters is controlled by four values: the actual ratio, the value of *scale*, and the values in column L, next to the labels *Left* and *Right*. The number of characters to replace is always 1, and the string to replace characters with is *.

When viewed together, the character strings in range G6..G17 suggest a line graph rotated 90 degrees. The positions of the asterisks indicate the company's position from month to month. The ratio of current assets to current liabilities decreased steadily during the year (range C6..C17). The graph makes it easier to see this trend.

The formula in cell G18 concatenates, or joins, the string *Weak*, 12 fewer hyphens than the value of *scale*, and the string *Strong*.

Finally, consider the formulas in column L. The formulas in cells L8, L9, L25, and L26 determine the highest and lowest values to be displayed in the graphs. Normally, these will be the highest and lowest of the actual values. If the highest actual value isn't as high as the highest RMA value or the lowest actual value isn't as low as the lowest RMA value, you'll get a value that's either

STATISTICS IS ESSENTIALLY
A MEANS OF ANALYZING THE PAST
AND PROJECTING THE FUTURE.
OFTEN A SIMPLE GRAPH CAN
INDICATE UPCOMING PROBLEMS.

20% above the highest or 20% below the lowest RMA. To see why the formula does this, look at the second graph. The year's most favorable debt-to-equity ratio, 1.2, occurs in May. Since the actual ratio for the 12 months being graphed never goes below the RMA for the same period, it would be misleading if the asterisk were placed at the extreme right side of the graph. Instead, the right-side value for the graph is calculated as 1.1, and the asterisk for the May ratio falls just short of that mark.

The formulas in cells L12, L13, L29, and L30 determine which numbers appear on the left and right sides of the graphs. If the switch value is 1, the minimum value appears on the left and the maximum value appears on the right. If the switch value is −1, the positions of the minimum and maximum values are reversed.

USING THE WORKSHEET

To adapt this worksheet for your company, enter your data in columns P and Q, starting in row 5. You may have this data in other worksheets. Use the File Xtract and File Combine commands to transfer the data into the mini-graph worksheet. If your data starts with a month other than January 1987, enter the value for the first day of that month in cell O5 as @DATE(*year*, *month*,1). If you enter more than two years' data, copy the formula for the last month as far down column O as

HOW TO SET UP THE WORKSHEET

1. Default settings

Column width: 7
Recalculation: Manual
Format: General

In *1-2-3* select /Worksheet Global Column-Width, enter 7, then select /Worksheet Global Recalculation Manual. In *Symphony* select MENU Settings Width, enter 7, then select Recalculation Method Manual Quit.

2. Column widths and range formats

Column A: 23
Column E: 16

With the cell pointer in the appropriate column, select /Worksheet Column Set-Width (in *Symphony*, MENU Width Set) and enter the column width.

Format	**Range**
Date 3	B1
Date 3	B6..B7
Fixed, 1	C6..D17
Fixed, 1	C23..D34
Date 3	O5..O28
Fixed, 1	P5..Q28
Fixed, 1	T5..U12
Percent (%), 0	S35..S39

To assign a format to a range, select /Range Format (in *Symphony*, MENU Format), select the format from the menu and, if necessary, enter the number of decimal places, then specify the range.

3. Labels

Cell	**Label**
A1	Start month of report
A4	Current Ratio
A6	Cur Assets/Cur Liab
A8	This common measure
A9	of liquidity explains
A10	how many times our
A11	current assets exceed
A12	our current
A13	liabilities.
B4	Month
C4	Actual
D4	RMA
E4	Comments

Right-align range B4..E4. Select /Range Label Right (in *Symphony*, MENU Range Label-Alignment Right) and specify range B4..E4.

B5	\–

Copy cell B5 to range C5..E5.
Copy cell B4..E5 to cell B21.

A21	Debt/Equity Ratio
A23	Total Debt/Net Worth
A25	This safety ratio
A26	shows how many times
A27	more debt than equity
A28	our company is using.
K8	Max
K9	Min
K10	Switch
K12	Left
K13	Right

Copy range K8..K13 to cell K25.

O1	PERFORMANCE RATIOS
S1	RMA RATIOS
O4	Month
P4	Current
Q4	Debt

Copy range P4..Q4 to cell T4.

S4	Year

Right-align the labels in range O4..U4.

S15	**Note: '89 Figures are estimates
S33	Lookup Table for Comments
S34	\–

Copy cell S34 to range T34..V34.

Begin the next five labels with a space.

T35	Terrible
T36	Poor
T37	Fair
T38	Good
T39	Excellent

necessary, and expand the range named *ratios* to include the new rows. If there are more than two types of ratios, insert new columns between columns P and Q.

Enter the standard ratios for your industry in place of the RMA ratios in range T5..U12. Enter the years to which the data pertains in column S, beginning in cell S5, and if necessary, change the size of the range named *rma* to include all the data you enter.

Also, if necessary, change the labels in column A so that they accurately describe the meanings of the graphs. Remember, the formulas above the graphs repeat the labels you enter in cells A4 and A21.

Be sure the column references in the @VLOOKUP formulas refer to the correct columns in the ranges *ratios* and *rma*. Also note that the formulas in column D reflect the assumption that the objective data for the industry is based on a July-to-June fiscal year. You may need to edit these formulas. Change the value following the greater-than sign (>) to the number representing the last month of the fiscal year. For example, with a fiscal year beginning in October, the formula in cell D6 would be:

@VLOOKUP(@YEAR(B6)+(@MONTH(B6)
>9),$rma,1)

Enter the starting month for the report in cell B1 and press CALC. This should produce two mini graphs that show how your company has fared in the last year. ■

4. Values

Cell	Value	Cell	Value	Cell	Value
L10	1	Q6	1.2	S9	86
L27	−1	Q7	1.5	S10	87
P5	2.8	Q8	1.9	S11	88
P6	2.8	Q9	2	S12	89
P7	2.8	Q10	2	T5	1.8
P8	2.8	Q11	1.3	U5	1.3
P9	2.7	Q12	2.1	T6	1.8
P10	2.7	Q13	1.4	U6	1.3
P11	2.7	Q14	1.9	T7	1.9
P12	2.7	Q15	1.7	U7	1.4
P13	2.6	Q16	1.5	T8	2
P14	2.6	Q17	2	U8	1.5
P15	2.6	Q18	1.8	T9	2
P16	2.6	Q19	1.6	U9	1.5
P17	2.6	Q20	1.4	T10	1.9
P18	2.5	Q21	1.2	U10	1.4
P19	2.4	Q22	1.3	T11	1.8
P20	2.3	Q23	1.5	U11	1.3
P21	2.2	Q24	1.7	T12	1.8
P22	2.1	Q25	1.9	U12	1.4
P23	2	Q26	2.1	S35	−1
P24	1.9	Q27	1.9	S36	−0.2
P25	1.8	Q28	1.7	S37	−0.1
P26	1.7	S5	82	S38	0.1
P27	1.6	S6	83	S39	0.2
P28	1.5	S7	84	T41	20
Q5	1.6	S8	85		

5. Range names

Name	Range	Name	Range
month	B1	*comments*	S35..T39
ratios	O5..Q28	*scale*	T41
rma	S5..U12	*frame*	T42

Press slash (in *Symphony,* MENU), select Range Name Create, enter the range name, and specify the range.

6. Enter and copy formulas

Cell	Formula
B1	@DATE(88,1,1)
B6	+$month
B7	+B6+33−@DAY(B6+32)
O5	@DATE(87,1,1)
T42	+"¦"&@REPEAT(" ",scale−2)&"¦"

Copy cell B7 to ranges B8..B17 and O6..O28.
Copy range B6..B17 to cell B23.

C6	@VLOOKUP(B6,$ratios,1)
D6	@VLOOKUP(@YEAR(B6)+(@MONTH(B6)>6), $rma,1)

Copy range C6..D6 to range C7..C17.

C23	@VLOOKUP(B23,$ratios,2)
D23	@VLOOKUP(@YEAR(B23)+(@month(B23)>6), $RMA,2)

Copy range C23..D23 to range C24..C34.

K11	@IF(L10=1,"(High is Strong)","(High is Weak)")

Copy cell K11 to cell K28.

L8	@MAX(C6..C17,@MAX(D6..D17)*(1+$S$39))
L9	@MIN(C6..C17,@MIN(D6..D17)/(1+$S$39))

Copy range L8..L9 to cell L25.

L12	@IF(L10=−1,L8,L9)
L13	@IF(L10=1,L8,L9)

Copy range L12..L13 to cell L29.

G4	@REPEAT(" ",($scale−@LENGTH(A4))/2)&A4
G5	@STRING(L12,1)&" "&@REPEAT("−", $scale−8)&" "&@STRING(L13,1)
G18	+"Weak "&@REPEAT("−",$scale−12)& " Strong"

Copy range G4..G18 to cell G21.

E6	@VLOOKUP(L$10*(C6/D6−1),$comments,1)
G6	@REPLACE($frame,($scale−1)*(C6−L$12) /(L$13−L$12),1,"*")

Copy range E6..G6 to range E7..E17.

E23	@VLOOKUP(L$27*(C23/D23−1),$comments,1)
G23	@REPLACE($frame,($scale−1)*(C23−L$29) /(L$30−L$29),1,"*")

Copy range E23..G23 to range E24..E34.

FINANCE

HOW TO CALCULATE EARNINGS PER SHARE

This versatile template simplifies determining the values that figure into this important performance indicator.

BY STEPHEN L. NELSON

Calculating earnings per share (EPS) should be pretty easy: Start with total earnings and divide by the number of shares of stock. Unfortunately, it isn't always that simple. And when it isn't, the worksheet described here can help.

Several factors can make EPS a bit complex to figure. First, the number of shares can change over the period for which EPS is calculated. Second, the capital structures of many businesses include stock options, warrants, and similar securities or rights. These blur the distinction between common stock and other types of stock. Hybrid securities such as convertible debt and convertible preferred stock further complicate calculating both total earnings and number of shares.

The four-step process described in this article takes account of all these complexities. With these steps, you can calculate earnings per share in accordance with standard accounting practices. The worksheet simplifies the steps. It consists of four separate but connected parts, arranged for easy viewing by using the PageUp and PageDown keys. As we discuss each step, we'll look at the corresponding section of the worksheet.

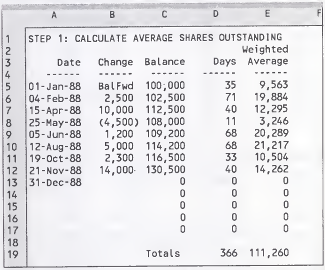
Step 1: Calculate average shares outstanding.
Record the varying levels of outstanding shares during a given period and weight those numbers with the length of time they were in effect. Look at figure 1. The dates in column A show that the period in question is calendar year 1988. The year started with 100,000 shares outstanding, as shown in cell C5. That amount stood until 2,500 more shares were issued on February 4. The formula in cell D5 calculates the period between January 1 and February 4 as 35 days. The formula in cell E5 multiplies the 100,000 shares by the quotient 35/366, giving the weighted average for that 35-day period.

The formula in cell C6 adds cell B6 to cell C5 and returns the outstanding shares as of the February 4 issue. Ten thousand more shares were issued on April 15, so 102,500 shares were outstanding for 71 days. The next change occurred on May 25 when 4,500 shares were redeemed, so 112,500 shares were outstanding for 40 days, and so forth. Cell E19 indicates the total of the weighted averages of the outstanding shares during the year—111,260.

Step 2: Calculate simple earnings per share.
Once you determine average outstanding shares, use that value and the net income available to common-stock holders to determine simple earnings per share.

To compute net income available to common-stock holders, record net income from your income statement and subtract any amounts owed to preferred-stock holders from the current period's earnings. Divide that difference by average outstanding shares and you get simple earnings per share.

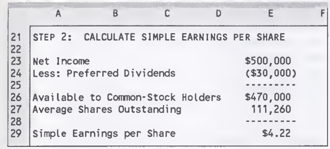
Note that if your firm's only owners' equity is common stock, you need only compute simple EPS. Steps 3 and 4 and the remainder of the worksheet are only necessary if you must factor in the effect of common-stock equivalents and dilutive convertible securities.



```
         A          B         C          D          E        F
1   STEP 1: CALCULATE AVERAGE SHARES OUTSTANDING
2                                              Weighted
3        Date    Change   Balance      Days   Average
4       ------   ------    ------    ------    ------
5   01-Jan-88    BalFwd   100,000        35     9,563
6   04-Feb-88     2,500   102,500        71    19,884
7   15-Apr-88    10,000   112,500        40    12,295
8   25-May-88   (4,500)   108,000        11     3,246
9   05-Jun-88     1,200   109,200        68    20,289
10  12-Aug-88     5,000   114,200        68    21,217
11  19-Oct-88     2,300   116,500        33    10,504
12  21-Nov-88    14,000   130,500        40    14,262
13  31-Dec-88                   0         0         0
14                              0         0         0
15                              0         0         0
16                              0         0         0
17                              0         0         0
18
19                        Totals        366   111,260
```

FIGURE 1. This portion of the worksheet lets you enter changes in shares outstanding, whether due to issues or redemptions, in range B6..B17. Balances, numbers of days the balances are in effect, and weighted averages are computed in range C5..E17. The weighted average for the entire period is computed in cell E19.

Stephen L. Nelson, CPA, is a consultant in Redmond, Wash., and author of Using DAC-Easy *(Que Corp., 1988).*



```
        A         B         C         D         E         F
21  STEP 2:  CALCULATE SIMPLE EARNINGS PER SHARE
22
23  Net Income                              $500,000
24  Less: Preferred Dividends               ($30,000)
25                                          ---------
26  Available to Common-Stock Holders       $470,000
27  Average Shares Outstanding               111,260
28                                          ---------
29  Simple Earnings per Share                  $4.22
```

FIGURE 2. Formulas in this portion of the worksheet adjust net income by subtracting amounts owed to preferred-stock holders. Cell E26 shows the amount available to common-stock holders. Cell E29 divides funds available by the weighted average of outstanding shares, giving simple earnings per share.

Step 3: Calculate primary and diluted EPS.

Many large firms issue convertible bonds, preferred stock, options, and other instruments. Holders of these instruments sometimes have the same rights as common-stock holders. If these instruments meet certain criteria, they are considered common-stock equivalents (CSEs) because they allow a holder to acquire, either through exercise or conversion, shares of common stock. If these instruments meet still other criteria, they are considered dilutive—that is, they decrease earnings per share or loss per share.

As with simple EPS, you compute primary EPS and fully diluted EPS by dividing earnings by outstanding shares. However, you must first adjust the numerator and denominator to account for securities that are common-stock equivalents or are dilutive.

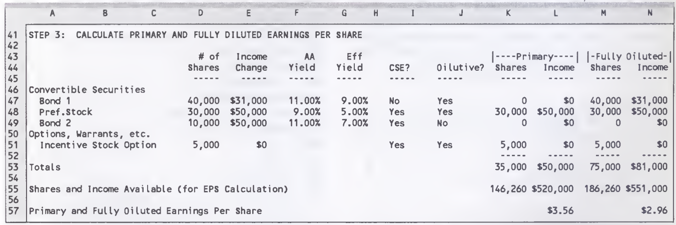
Look at row 47 in figure 3. The company has issued a bond that can be converted to 40,000 shares of common stock, increasing outstanding shares by that amount. If the issue is converted, net income available to common-stock holders will increase $31,000, because converting the bond decreases after-tax interest expense.

Because this is a convertible bond, accounting standards dictate that you determine whether it is a CSE by comparing its yield to the yield of AA-rated bonds at the time this firm's bond is issued. AA is a rating that an agency such as Moody's Investment Services or Standard & Poor's gives to the bond. The AA rating is given to high-quality bonds where the bond's issuer is capable of paying interest and repaying principal. You treat convertible bonds as CSEs if the effective yield is less than two-thirds of the AA yield. The bond described in row 47 was issued when AA bonds had a yield of 11%. Its own effective yield is 9%. Cell I47 contains an @IF formula that returns *Yes* if cell G47 is less than cell F47 times ⅔; otherwise, it returns *No*.

To determine if a security is dilutive, divide the change in income resulting from its conversion by the change in shares. If this quotient is less than the company's simple earnings per share, the security is dilutive. The formula in cell J47 performs this test and returns *Yes* or *No*, as appropriate. (In *1-2-3* Release 1A, cell J47 returns three plus signs to indicate yes or a single period to indicate no.)

Columns K and L calculate primary earnings per share. If a security qualifies as a CSE and is dilutive, the changes in shares and in income it produces are factored into the shares and available-income values used to calculate primary EPS. The formulas in range K47..L51 compute share and income changes for primary EPS purposes. The bond described in row 47 is dilutive but is not a CSE, so the formulas in cells K47 and L47 both return 0. By contrast, the preferred stock described in row 48 is a CSE and is dilutive, so cells K48 and L48 repeat the values in cells D48 and E48.

Columns M and N of the worksheet calculate fully diluted earnings per share. If a security is dilutive, its share and income changes are factored into the shares and available-income values used to calculate diluted



```
       A         B         C        D         E         F         G    H      I          J         K         L          M        N
41  STEP 3:  CALCULATE PRIMARY AND FULLY DILUTED EARNINGS PER SHARE
42
43                                  # of    Income       AA       Eff                            |----Primary----|  |-Fully Diluted-|
44                                 Shares   Change     Yield     Yield      CSE?     Dilutive?  Shares    Income    Shares   Income
45                                 -----    -----      -----     -----      -----    -----      -----     -----     -----    -----
46  Convertible Securities
47    Bond 1                       40,000  $31,000    11.00%     9.00%      No       Yes            0        $0    40,000  $31,000
48    Pref.Stock                   30,000  $50,000     9.00%     5.00%      Yes      Yes       30,000   $50,000    30,000  $50,000
49    Bond 2                       10,000  $50,000    11.00%     7.00%      Yes      No             0        $0         0       $0
50  Options, Warrants, etc.
51    Incentive Stock Option        5,000       $0                          Yes      Yes        5,000        $0     5,000       $0
52                                                                                               -----     -----     -----    -----
53  Totals                                                                                      35,000   $50,000    75,000  $81,000
54
55  Shares and Income Available (for EPS Calculation)                                          146,260  $520,000   186,260 $551,000
56
57  Primary and Fully Diluted Earnings Per Share                                                          $3.56              $2.96
```

FIGURE 3. This section of the worksheet calculates primary and fully diluted earnings per share. Enter information on the securities that your firm issues in columns D and E. Columns I and J determine whether a security is a common stock equivalent or is dilutive. Formulas in range K47..N51 return either zeros or the securities' share and income changes, depending on whether the securities should be factored into primary or diluted EPS. Formulas in row 55 add the totals from their respective columns to the average outstanding shares or funds available to common-stock holders, and the formulas in row 57 divide the adjusted incomes by the adjusted shares.

HOW TO SET UP THE WORKSHEET

1. Default settings

In *1-2-3* select /Worksheet Global Format, select the comma from the menu, and enter *0*. Then select /Worksheet Global Recalculation Manual.

In *Symphony* select MENU Settings Format Punctuated, enter *0*, then select Recalculation Method Manual Quit.

2. Column widths, range formats

Set the width of column A to 10: With the cell pointer in column A, select /Worksheet Column Set-Width (in *Symphony*, MENU Width Set) and enter *10*. In the same manner, set the width of column H to 4.

To assign the following formats, select /Range Format (in *Symphony*, MENU Format), select the format, enter the number of decimal places or press Return for the default of two decimal places, and specify the cell or range.

Format	Range
Date 1	A5..A17
Currency, 0	E23..E26
Currency, 2	E29
Currency, 0	E47..E51
Percent (%), 2	F47..G49
+/−	I47..J51 (*1-2-3* Release 1A only)
Currency, 0	L47
Currency, 0	N47
Currency, 0	L53..L57
Currency, 2	L57
Currency, 2	D63..D65
Percent, 2	D67

3. Labels

Enter the labels shown in rows 1 to 3 and in cell B5 of figure 1. Enter a quotation mark and five hyphens ("-----) in cell A4, and copy cell A4 to range B4..E4. Enter the label shown in cell C19.

Enter the labels shown in column A of figure 2, then enter backslash hyphen (\−) in cells E25 and E28.

Enter the labels shown in column A of figure 3, beginning the indented ones with two spaces. Enter the labels shown in rows 43 and 44; begin the labels in cells K43 and M43 with one space. Enter an apostrophe and five hyphens in cell D45, and copy cell D45 to ranges E45..G45 and I45..N45. Right-align the labels in ranges D43..G45 and K44..N45: Select /Range Label Right (in *Symphony*, MENU Range Label-Alignment Right) and specify the appropriate range. Copy range K45..N45 to cell K52. Finally, enter *Yes* in cell I51; in *1-2-3* Release 1A, enter the value 3 in this cell.

Enter the labels shown in range A61..A67 of figure 4.

4. Values

Enter the values shown in the following ranges:

Figure 1	B6..B12, C5
Figure 2	E23..E24
Figure 3	D47..G51

5. Enter and copy formulas

Cell	Formula
A5	@DATE(88,1,1)
A6	@DATE(88,2,4)
A7	@DATE(88,4,15)
A8	@DATE(88,5,25)
A9	@DATE(88,6,5)
A10	@DATE(88,8,12)
A11	@DATE(88,10,19)
A12	@DATE(88,11,21)
A13	@DATE(88,12,31)
D5	+A6−A5+1
E5	+D5/$D$19*C5

Copy cell E5 to range E6..E17.

Cell	Formula
C6	@IF(B6,C5+B6,0)
D6	@IF(A7,A7−A6,0)

Copy range C6..D6 to range C7..C17.

Cell	Formula
D19	@SUM(D4..D17)

Copy cell D19 to cell E19, then press the CALC key.

Cell	Formula
E26	+E23+E24
E27	+E19
E29	@ROUND(E26/E27,2)

Formulas for *1-2-3* Release 2/2.01 and *Symphony*.

Cell	Formula
I47	@IF(G47<F47*2/3,"Yes","No")
J47	@IF(E47/D47<$E$29,"Yes","No")
K47	@IF($I47="Yes"#AND#$J47="Yes",D47,0)
L47	@IF($I47="Yes"#AND#$J47="Yes",E47,0)
M47	@IF($J47="Yes",D47,0)
N47	@IF($J47="Yes",E47,0)

Formulas for *1-2-3* Release 1A.

Cell	Formula
I47	@IF(G47<F47*2/3,3,0)
J47	@IF(E47/D47<$E$29,3,0)
K47	@IF($I47=3#AND#$J47=3,D47,0)
L47	@IF($I47=3#AND#$J47=3,E47,0)
M47	@IF($J47=3,D47,0)
N47	@IF($J47=3,E47,0)

Copy range I47..N47 to range I48..I49. Copy range J47..N47 to cell J51.

Cell	Formula
K53	@SUM(K45..K52)
L53	@SUM(L45..L52)
K55	+K53+$E$19
L55	+L53+$E$26
L57	@ROUND(L55/K55,2)

Copy range K53..L57 to cell M53.

Cell	Formula
D63	+E29
D65	+N57
D67	(D63−D65)/D63
A70	@IF(D67>=0.03, "Difference is material, report primary and fully diluted", "Difference is immaterial, OK to report only simple")

In *1-2-3* Release 1A, omit cell A70 or enter the label If D67 is 3% or higher, report primary and fully diluted EPS.

EPS. This is true whether or not the security is a CSE. The formulas in range M47..N51 compute share and income changes for fully diluted EPS purposes.

Stock options, warrants, and similar rights entitle their holders to acquire common stock at a set price per share, regardless of the stock's market value. If the holder exercises the option, the company uses the proceeds to redeem shares. Therefore, these rights do not affect available income, only the number of outstanding shares. Row 51 describes a scenario wherein the company has issued an option to acquire 10,000 shares at $15 per share. The proceeds from the exercise are $150,000. If the stock is currently selling for $30 per share, these proceeds enable the company to redeem 5,000 shares. We've therefore entered *5000* in cell D51.

Options and warrants are, by definition, common-stock equivalents. So when you create this section of the worksheet, you will enter the label *Yes* in cell I51 instead of copying the string-returning formula from cell I47.

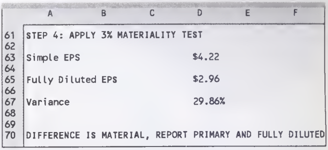
The formulas in row 53 total the values from their respective columns in rows 45 through 52. The formulas in cells K55 and M55 add the values above them in row 53 to the weighted average of outstanding shares in cell E19 of figure 1. The formulas in cells L55 and N55 add the corresponding values from row 53 to the income available to common-stock holders in cell E26 of figure 2. Finally, the formulas in row 57 divide change in income by change in shares to return the primary and fully diluted earnings per share.

Step 4: Apply 3% materiality test.

The final step is not, strictly speaking, part of determining EPS. Rather, it helps you decide which variety of EPS to report on your financial statements. According to financial accounting standards, you must report primary and fully diluted EPS if fully diluted EPS differs materially from simple EPS. A difference of 3% or more is considered material. A difference of less than 3% is considered immaterial, and you need to report only simple EPS on your statements.

The formulas in cells D63 and D65 repeat the simple and fully diluted EPS values from the second and third sections of the worksheet. The formula in cell D67 divides the difference between simple and diluted EPS by simple EPS, giving the variance between the two as a percentage of simple EPS. The formula in cell A70 returns one of two character strings. If the variance in cell D67 is less than 3%, cell A70 returns the sentence *Difference is immaterial, OK to report only simple*. If the variance is 3% or higher, as in this example, cell A70 returns the sentence shown in figure 4. This formula will not work in *1-2-3* Release 1A. If you use Release 1A, omit the entry in cell A70, or enter a label to remind yourself how to evaluate cell D67.

To create this worksheet, follow the instructions in the box on the opposite page.



```
      A         B         C         D         E         F
61  STEP 4: APPLY 3% MATERIALITY TEST
62
63  Simple EPS                    $4.22
64
65  Fully Diluted EPS             $2.96
66
67  Variance                      29.86%
68
69
70  DIFFERENCE IS MATERIAL, REPORT PRIMARY AND FULLY DILUTED
```

FIGURE 4. This screen helps you determine which EPS figure to report on your financial statement. Cell D67 computes the percentage by which fully diluted EPS differs from simple EPS. Cell A70 contains an @IF formula that returns the sentence shown if the value in cell D67 is greater than or equal to 3%. If cell D67 is less than 3%, cell A70 returns *Difference is immaterial, OK to report only simple*. Note that the formula in cell A70 is omitted in the *1-2-3* Release 1A version.

USING AND EXPANDING THE MODEL

With just a little modification, this worksheet can become a foundation for your firm's EPS worksheet.

The first section will accommodate up to 12 changes in the number of shares outstanding. To allow for more changes than that, add rows between rows 16 and 17, then copy range C15..E15 (not C16..E16) into the range that extends from cell C16 to what's now the location of the last *Balance* formula. You must copy the formulas from row 15 instead of 16. Each formula in column D normally contains references to the cell in column A that's one row below it. After you add rows, cell D16 contains references to a cell several rows below. Copying row 15 formulas restores all relative cell references.

To accommodate additional convertible securities, add rows between rows 49 and 50; for more options and warrants, add rows between rows 51 and 52.

Because your firm may have several types of net income figures from which to derive EPS, you might need to use several versions of this worksheet. For example, if you report net income both before and after some extraordinary event, you'll want to calculate EPS based on both net income values.

Calculating earnings per share is tricky for businesses with complex capital structures. See the box below for a list of materials that detail the rules for calculating and reporting earnings per share. ■

WHERE TO GET EPS GUIDELINES

The following materials are in your firm's corporate library or local business school library:

- Accounting Principles Board (APB) Opinions 15 and 30
- American Institute of Certified Public Accountants (AICPA) Interpretations of APB Opinions 15 and 20
- Financial Accounting Standards Board (FASB) Statements 21, 55, and 85
- FASB Interpretations 28 and 31

Anatomy of a
1-2-3 GRAPH

Learn how data in neat rows and columns evolves into line, bar, pie, and XY graphs.

BY KEN SAUL

STEVE LYONS

A spreadsheet is great when you want to organize and analyze information, but it doesn't always make it easy for you to quickly find answers to your questions. Look at the worksheet in figure 2 and answer the following questions. Did any country consistently have the lowest sales each month? Do two or more countries show the same trend in monthly sales?

Glancing over the spreadsheet, you can't answer these questions easily. But if you look at the series of graphs in figures 2 through 7, the answers are apparent.

This article helps you learn how to build the five graph types available in *1-2-3*. You'll explore each

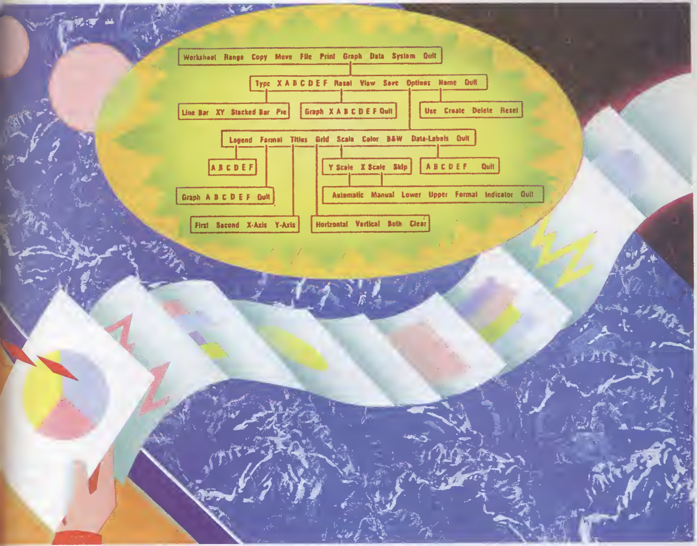

Worksheet Range Copy Move File Print Graph Data System Quit
Type X A B C D E F Reset View Save Options Name Quit
Line Bar XY Stacked Bar Pie
Graph X A B C D E F Quit
Use Create Delete Reset
Legend Format Titles Grid Scale Color B&W Data-Labels Quit
A B C D E F
Y Scale X Scale Skip
A B C D E F Quit
Graph A B C D E F Quit
Automatic Manual Lower Upper Format Indicator Quit
First Second X-Axis Y-Axis
Horizontal Vertical Both Clear

FIGURE 1. The *1-2-3* Release 2/2.01 Graph menu

choice on the Graph menu in figure 1, learn the uses for each graph type, and build the sample graph shown in figure 2. You'll learn enough to build the other graphs on your own. Before you begin, make sure your computer has a graphics card and that you have used the Install program to select the appropriate graphics card driver.

DATA RANGES

Planning is essential to good graphing. Begin by arranging your data in contiguous cells in either rows or columns. Unless a particular data point is truly missing, don't leave any blank cells in the data ranges. Also, keep the sizes of the data ranges identical.

You can specify data ranges X and A through F. The X range can contain values or labels. In all graphs except the pie, the X range contains the data that appears on a graph's X axis. In the pie graph, the X range contains labels that appear adjacent to each pie wedge. The X range of XY graphs always contains values.

Every graph type except the pie can plot up to six data ranges, which correspond to the A through F data ranges. Pie graphs are limited to only one data range.

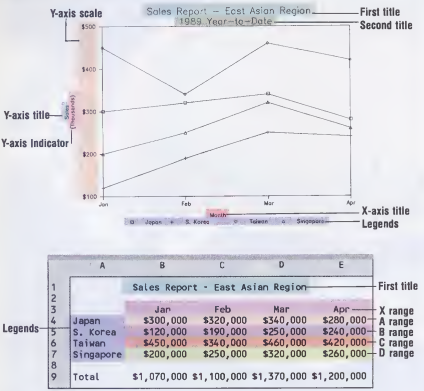
THE OPTIONS

Although they are called options, these settings perform essential functions that convey the message of your graph.

Legend: A legend is a label that appears below the graph and describes a data range. On a graph, *1-2-3* displays each legend along with its corresponding symbol and shading or color of the line or bar.

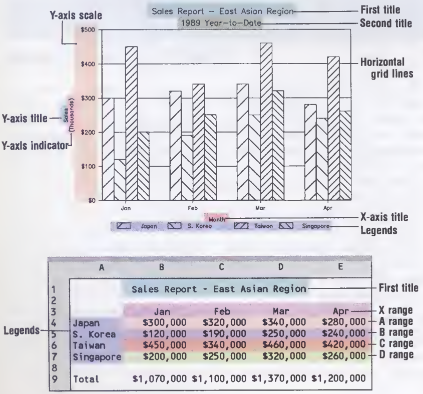
There are two methods for entering legend text. You may enter it manually or, if a cell in the worksheet contains a label that you want to use as a legend, enter a backslash and the cell address. For viewing purposes only, not in print, each manually entered legend is limited to 19 characters. The limit is less precise in the case of legends entered as cell addresses, so rely on trial and error. Figures 2, 3, and 4 show legends. The Legend option does not apply to pie graphs.

FIGURE 2. A line graph



	A	B	C	D	E
1		Sales Report - East Asian Region			
2					
3		Jan	Feb	Mar	Apr
4	Japan	$300,000	$320,000	$340,000	$280,000
5	S. Korea	$120,000	$190,000	$250,000	$240,000
6	Taiwan	$450,000	$340,000	$460,000	$420,000
7	Singapore	$200,000	$250,000	$320,000	$260,000
8					
9	Total	$1,070,000	$1,100,000	$1,370,000	$1,200,000

FIGURE 3. A multiple-range bar graph



	A	B	C	D	E
1		Sales Report - East Asian Region			
2					
3		Jan	Feb	Mar	Apr
4	Japan	$300,000	$320,000	$340,000	$280,000
5	S. Korea	$120,000	$190,000	$250,000	$240,000
6	Taiwan	$450,000	$340,000	$460,000	$420,000
7	Singapore	$200,000	$250,000	$320,000	$260,000
8					
9	Total	$1,070,000	$1,100,000	$1,370,000	$1,200,000

Note that in *1-2-3*, what you view is not what you get in print. So, if you want to view *and* print a graph, a different set of legend limits applies. The tables below show the total number of characters you can print with PrintGraph. For example, if you're printing a bar graph and have two legends, you can use a total of 38 characters for the two legends, divided between the two any way you wish. If you're using only one legend, however, you may make it only 19 characters long.

Bar and Stacked-Bar Graphs

Number of Legends	Total Characters
6	15
5	21
4	27
3	33
2	38
1	19

Line and XY Graphs

Number of Legends	Total Characters
6	18
5	24
4	30
3	36
2	38
1	19

Format: The Format option lets you select the method of graphing data values in line and XY graphs. You can set the format for the entire graph or for individual data ranges. The choices are Lines, which connects data points by a line; Symbols, which plots a symbol at each data point; Both, the default setting, which displays lines and symbols; and Neither, which suppresses both lines and symbols. Figure 2 shows both lines and symbols connecting data points. Figure 7, the XY graph, shows symbols without lines as the format for the A range.

Titles: When you use the Titles option, you specify text that appears at the top of the graph and along the X and Y axes. The choices are First, Second, X-Axis, and Y-Axis. The First title appears at the top of the graph. The Second title is a subtitle, which appears directly under the First title. The X-Axis title appears between the bottom of the graph and any legends. The Y-Axis title appears vertically along the left edge of the graph. You can manually enter a title of up to 39 characters. To specify a title longer than 39 characters, enter the title in a cell in the worksheet and then enter a backslash and the cell address. If a cell in the worksheet already contains a label that you want to use as a title, enter a backslash and the cell address. All the figures show some use of titles. Note that pie graphs do not use X-Axis and Y-Axis titles.

Grid: The Grid option lets you display horizontal, vertical, or both horizontal and vertical lines on your graph. These grid lines appear at X- and Y-axis scale positions and help you identify the values of the data points. Figure 3 shows horizontal grid lines on a bar graph. The Grid option does not apply to pie charts.

Scale: *1-2-3* automatically generates X- and Y-axis numeric scales that fit your data. But sometimes you'll want to use the Scale option to set the lower and upper limits yourself. The choices are Y Scale, X Scale, and Skip. Selecting Y Scale or X Scale presents a whole menu of additional choices, which we'll explore in a moment.

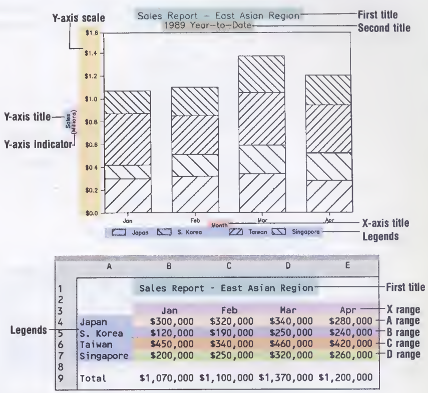
If you select Skip, you can specify a skip factor and avoid cluttered or overlapping labels on the X axis. This overcrowding often occurs when your X range is large. If you notice this problem on your graph, specify a skip factor to show only the nth entry in the X range. For example, a skip factor of 5 shows the first, sixth, eleventh, and so on, entries along the X axis.

If you select Y Scale or X Scale, you have additional menu choices to make: Automatic, Manual, Lower, Upper, Format, Indicator.

The Automatic option is the default, but you can select Manual to control the scaling on an axis. Manual scaling of the Y axis is appropriate for line, bar, stacked-bar, and XY graphs. Manual scaling along the X axis applies only to XY graphs. To return to Automatic after using Manual, select Automatic. Figure 7 shows manual scaling of both axes.

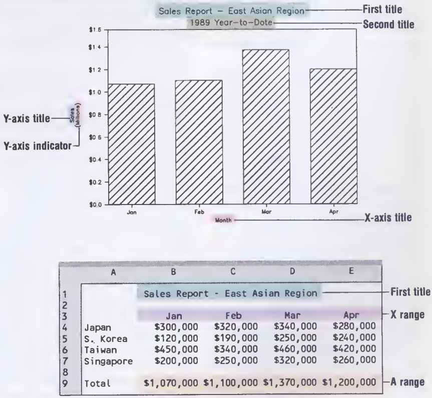
When you select Manual, you

FIGURE 4. A stacked-bar graph



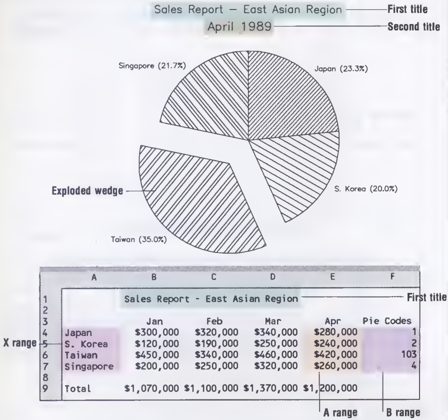
	A	B	C	D	E
1		Sales Report - East Asian Region			
2					
3		Jan	Feb	Mar	Apr
4	Japan	$300,000	$320,000	$340,000	$280,000
5	S. Korea	$120,000	$190,000	$250,000	$240,000
6	Taiwan	$450,000	$340,000	$460,000	$420,000
7	Singapore	$200,000	$250,000	$320,000	$260,000
8					
9	Total	$1,070,000	$1,100,000	$1,370,000	$1,200,000

FIGURE 5. A single-range bar graph



	A	B	C	D	E
1		Sales Report - East Asian Region			
2					
3		Jan	Feb	Mar	Apr
4	Japan	$300,000	$320,000	$340,000	$280,000
5	S. Korea	$120,000	$190,000	$250,000	$240,000
6	Taiwan	$450,000	$340,000	$460,000	$420,000
7	Singapore	$200,000	$250,000	$320,000	$260,000
8					
9	Total	$1,070,000	$1,100,000	$1,370,000	$1,200,000

FIGURE 6. A pie graph



	A	B	C	D	E	F
1		Sales Report - East Asian Region				
2						
3		Jan	Feb	Mar	Apr	Pie Codes
4	Japan	$300,000	$320,000	$340,000	$280,000	1
5	S. Korea	$120,000	$190,000	$250,000	$240,000	2
6	Taiwan	$450,000	$340,000	$460,000	$420,000	103
7	Singapore	$200,000	$250,000	$320,000	$260,000	4
8						
9	Total	$1,070,000	$1,100,000	$1,370,000	$1,200,000	

must specify lower and upper scaling limits. *1-2-3* displays all the data points that fall within the limits. Depending on the limits you specify, some of your data points may not appear on the graph.

The Format option lets you select a display format for the values on the scales. The default appearance is General. All the standard cell display formats are available for use in the scales. Among the figures, you'll find all Y-axis scales formatted for currency. Figure 7, the XY graph, shows the X-axis scale also formatted for currency.

The Indicator option lets you decide whether the graph will display labels indicating the magnitude of the graphed values. An indicator automatically appears adjacent to an axis that is graphing numeric data. For example, the label *(Thousands)* appears as the indicator for the X and Y scales of the XY graph in figure 7. Note that the X-scale indicator applies only to XY graphs, as no other graph type plots numeric data on the X axis. By selecting Y Scale (or X Scale) Indicator No, you suppress the label for that particular axis. The Indicator option is not available in *1-2-3* Release 1A.

Color: The Color option displays data ranges in contrasting colors if you have a color monitor.

B & W: The B&W option displays data range bars in different monochrome cross-hatchings. Use this option only if you previously selected the Color option and want to return to monochrome display.

Data-Labels: The Data-Labels option lets you assign a descriptive label to each data range. For example, figure 7 displays centered names of the months that correspond to each data point. You can place labels to the left or right of the data or above, below, or centered on the data points. However, bar graphs ignore your selection and always display data labels centered above positive bars and centered below negative bars. The Data-Labels option does not apply to pie graphs.

RESET, NAME, SAVE, USE

You can use the Graph Reset command to cancel all the graph settings or only the settings for particular data ranges. /Graph Reset Graph cancels all data ranges, titles, formats, scales, and any other specified options. More commonly you will select the Graph Reset command and cancel settings for specified data ranges. Resetting an individual range automatically resets the corresponding data label. It does not, however, delete a corresponding legend.

The Graph Name Create command saves the current graph settings under a graph name. Use this command to save more than one graph with a worksheet. After constructing each graph, select /Graph Name Create and enter a unique name of up to 14 characters. If you modify a named graph, reissue the Graph Name Create command to save the changes. After creating and naming a graph, select /File Save to save the file and its settings.

Selecting /Graph Name Delete deletes a named graph. Selecting /Graph Name Reset cancels every named graph. Because these commands don't give you a chance to change your mind, be careful when you use them. If you select one of these commands by mistake, immediately retrieve the original file. Named graphs that were previously saved with the file will still be intact.

The Graph Name Use command makes the settings of a specified graph current and displays the graph. Use this command to cycle through the series of named graphs that are attached to the worksheet file.

If you want to print out your graph, be sure to select /Graph Save to save the graph as a PIC file that you can print out using PrintGraph.

THE LINE GRAPH

A line graph is useful when you want to show changes in data over time. For example, looking at figure

2, you quickly note that Japan, South Korea, and Singapore show similar trends in sales. The data you specify as the X range appears as labels on the X axis of the graph and identifies each data point. By specifying data for graph data ranges A through F, you can plot up to six lines on a single graph. *1-2-3* automatically assigns a different symbol to each line and displays the values as symbols connected by lines, as in figure 2. If you use a color monitor, select /Graph Options Color Quit View to display each line on the graph in a different color.

THE BAR GRAPH

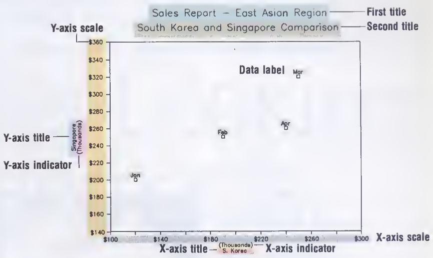
The bar graph comes in two varieties, single-range graph and multiple-range graph. A single-range bar graph, like the one in figure 5, highlights the differences between values in one set of data. In this case, you're comparing total sales by month. Looking at the graph, you quickly see that total sales shot up in March, while sales in January and February remained level. April showed a decline from the March sales level.

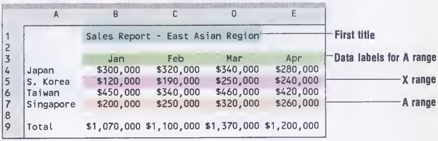
A bar graph always displays labels along the X axis. In a single-range bar graph, you specify data for only the A range. The data for bars can be positive or negative. Although *1-2-3* automatically scales the Y axis based on graph values, you can scale the upper limit of the Y axis manually. *1-2-3* does not let you scale the lower limit manually.

Bars in a bar graph automatically appear shaded with different cross-hatch patterns. If you have a color monitor, however, you can select the Color option and display bars as solid colors. For each bar, you may specify a data label, which appears centered above a positive bar and below a negative bar. You may also choose to draw horizontal grid lines, as in figure 3. The grid lines appear at the points used as the Y-axis scaling.

A multiple-range bar graph is useful when you want to make comparisons between corresponding values in data sets. In figure 3, you easily see the total monthly sales for each country, whereas the single-range bar graph emphasized total monthly sales for all of the countries. Instead of specifying data for only the A range, you've specified data for the B, C, and D ranges as well. And instead of one large bar representing each month, you see groups of four slim bars. Each group represents one month, while each slim bar represents one country's sales for that month.

FIGURE 7. An XY graph





	A	B	C	0	E
1		Sales Report - East Asian Region			
2					
3		Jan	Feb	Mar	Apr
4	Japan	$300,000	$320,000	$340,000	$280,000
5	S. Korea	$120,000	$190,000	$250,000	$240,000
6	Taiwan	$450,000	$340,000	$460,000	$420,000
7	Singapore	$200,000	$250,000	$320,000	$260,000
8					
9	Total	$1,070,000	$1,100,000	$1,370,000	$1,200,000

In a stacked-bar graph, each segment of a bar represents a corresponding value from each data range. In figure 4, the segments are stacked on top of each other to show each country's individual monthly sales as part of total monthly sales. The height of each bar indicates that month's total sales. *1-2-3* automatically creates different cross-hatch patterns for each segment of the stacked bar. Each stacked bar can contain up to six bar segments. A bar on a stacked-bar graph can plot negative data only if all its segments are negative.

THE PIE GRAPH

A pie graph, like the one shown in figure 6, compares parts to the whole. Here you see the relationship that each country's sales in April had to total April sales. *1-2-3* automatically calculates and displays percentages, a feature you cannot suppress.

In a pie graph, the X range contains labels to identify each wedge. The A range contains the values to be graphed; the B range contains codes for the shading or color of the wedges. The shading codes are numbered 0 through 7. An "exploded" wedge, such as the Taiwan wedge in figure 6, emphasizes a particular point in a presentation. To explode a wedge, add 100 to the shading code. Shading codes and exploding wedges are not available in *1-2-3* Release 1A.

A pie graph is the least flexible *1-2-3* graph. Graph settings that don't apply to pie graphs are the C, D, E, and F data ranges. Options that don't apply are Legend, Format, X-Axis and Y-Axis Titles, Grid, Scale, and Data-Labels.

THE XY GRAPH

An XY graph pairs each value from the X range with the corresponding value from each of the A through F ranges to plot points on the graph. Figure 7 shows an XY graph correlating sales in Singapore and South Korea. An XY graph differs from a line graph in that its X axis displays numbers, not labels. *1-2-3* automatically scales the X and Y axes and assigns both lines and symbols as the format for the graphed data. Depending on the data plotted, the lines connecting data points may zigzag across the graph, making for a confusing presentation. Should this occur, specify Symbols as the format for each data range, and no lines will appear on the graph. All options apply to the XY graph.

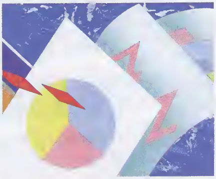
BUILD A SAMPLE GRAPH

As you follow the directions for building the simple line graph in figure 2, you'll become familiar with the *1-2-3* graph menu in figure 1. Using the same sample data you use for the line graph, you can also build the single-range bar, multiple-range bar, stacked-bar, pie, and XY graphs in figures 3 through 7.

Begin by entering the sample sales worksheet from figure 2. First, set a global column width. Press slash, select Worksheet Global Column-Width, and enter *11*. Then select /Range Format Currency, enter *0*, and indicate range B4..E9. Enter all the labels and values shown, except the values in range B9..E9. To center the labels in range B3..E3, precede each one with a caret (^). Then in cell B9 enter the formula @SUM(B4..B7). Copy that cell to range C9..E9.

Now that you have your data, you can build a graph in three easy steps. First, select the type of graph. Second, specify the ranges containing the data that will appear on the graph. Third, enhance the appearance of the graph by specifying titles and formats.

To begin building the line graph showing monthly sales in each country, select /Graph Type Line. A line graph is the default graph type. Next specify the ranges to be graphed. In a line graph, the X range contains the labels that appear along the X axis. Select X and specify range B3..E3. Each range, A through F, appears as a single line on the graph. For this graph, you'll plot four lines, one for each country. First select A and then specify range B4..E4. Select B and specify range B5..E5. Then select C and specify range B6..E6. Finally, select D and specify range B7..E7.



Select View to look at your graph. *1-2-3* has plotted four lines, each representing sales for one of the East Asian countries. The X axis of the graph displays the month labels. The Y axis automatically displays a series of values, known as the Y-axis scale, that fit your data. To determine these values, *1-2-3* evaluates all the data ranges and determines that the lowest value is around 100,000, while the highest is around 500,000. With this information, *1-2-3* automatically generates the Y-axis indicator, *(Thousands)*. The points graphed for each country automatically appear as symbols connected by lines.

In its current state, this graph fails to convey a meaningful message. Use the graph options to remedy the situation.

Titles in figure 2 appear above the graph and along the X and Y axes. You can enter titles by typing the text or, if the worksheet already contains the text, by entering a backslash and the cell address. Press any key to return to the Graph menu. Then select Options Titles First and enter *\B1*. Select Titles Second and enter *1989 Year-to-Date*. Select Titles X-Axis and enter *Month*. Select Titles Y-Axis and enter *Sales*.

Use the same method to enter legends, which identify the symbols that *1-2-3* has automatically assigned to each line of the graph. The legend labels should identify the data being graphed. Select Legend A and enter *\A4*. Select Legend B and enter *\A5*. Select Legend C and enter *\A6*. Select Legend D and enter *\A7*.

Now assign a currency format to the values on the Y axis. Select Scale Y-Scale Format Currency and enter *0*. Select Quit Quit View. Your graph should look like figure 2. To save the graph with the file, press any key, select Name Create, and enter a name. Then select Quit. Select /File Save to save the file containing your sample data and the named line graph. If you wish to print your graph, select /Graph Save and enter a file name. *1-2-3* saves the graph as a PIC file that you can later print out using PrintGraph.

Next, try converting the simple line graph into a multiple-bar or stacked-bar graph. Select Type Bar View or Type Stacked Bar View. The graphs you see will look similar to those in figures 3 and 4. The figures show the use of three options: horizontal grid lines on the multiple-range bar graph in figure 3, and formatting and manual scaling of the Y axis in the stacked-bar graph in figure 4. With what you now know about the Graph menu, you can alter the graphs on your screen to look exactly like the figures. Then you can build the single-range bar, pie, and XY graphs shown in figures 5 through 7, respectively. ■

Ken Saul is a process-control engineer with Hewlett-Packard.

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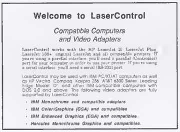

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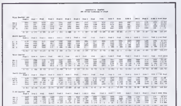

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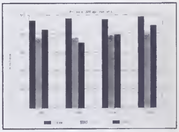

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CIRCLE 111 ON READER SERVICE CARD

BY ALFRED GLOSSBRENNER

A GUIDE TO PUBLIC DOMAIN SOFTWARE

A host of programs designed to enhance *1-2-3* and *Symphony* are available free or almost free. Here are some best bets and tips on where to find them.

The prospect of getting something for nothing is always alluring. And so it is with software. In this article you'll learn about the world of free (public domain) and almost free (shareware) programs designed to work with *1-2-3* and *Symphony*. When authors place programs in the public domain, they give up their copyright and the program can be freely distributed. Shareware authors retain the copyright but distribute their program through public domain channels. Shareware authors ask you to pay a registration fee (usually around $30) if you use their product. Payment often entitles you to telephone support, a printed and bound manual, and notification of upgrades and new releases. Many shareware authors offer site licenses that make a number of copies of the program available to users at one location.

You can get *1-2-3* and *Symphony* public domain programs and shareware programs from on-line information services and mail-order houses. You must have a modem and communications software, and you must pay a connect charge to download programs from an information service. A mail-order house usually requires you to pay a fee for a catalog and a per-disk service charge when you order a program. This article focuses on the two distributors of *1-2-3* and *Symphony* public domain software that have the greatest variety of programs to choose from.

The World of Lotus on CompuServe, maintained by Lotus Development Corp., is a special-interest, on-line forum. It is a magnet for avid *1-2-3* and *Symphony* users. Within this forum are 11 data libraries that contain all sorts of public domain software. There are

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Alfred Glossbrenner is the author of Alfred Glossbrenner's Master Guide to Free Software for IBMs and Compatible Computers *(St. Martin's Press, 1989).*

scores of *1-2-3* and *Symphony* application templates, tutorial worksheets, macro collections, utility programs, and add-in programs. You can download any program in the libraries for your own use. The World of Lotus file named DLSUM.ARC in Data Library 1 provides a summary of every program in the data libraries.

The Public Software Library (PsL) is arguably the definitive *1-2-3* and *Symphony* mail-order library. It offers add-ins, macros, worksheet utilities, and full-blown applications. Only three or four of the 70 PsL disks are labeled Miscellaneous. The rest group software into categories such as Financial, Graphics, and *Symphony* Add-Ons, so it's easy to find the type of program you need. PsL Disk #992 is the Lotus Catalog Disk, which contains the current inventory, along with one-line descriptions of each program. PsL charges $5 for each disk, plus $4 for shipping and handling. If you want to use a program, you then pay the program's author the suggested fee.

The programs that follow are a smattering of what's available from these two distributors. The programs all work well with *1-2-3* Releases 2 and 2.01 and with all releases of *Symphony*, and as a group, they present a good introduction to the world of public domain software and shareware. Most of these programs are also available from other distributors (see In Brief box).

TIPS, TUTORIALS, AND TEACHING TOOLS

TECHNOJOCK'S TUTORIAL is a handy program for *1-2-3* beginners. Advanced users may also find value in it. The tutorial covers menus, printing, and databases. It discusses each topic in the context of a worksheet and develops as a series of menu-driven lessons that build upon each other. For example, the author shows you a macro, explains each of its parts in detail, and then demonstrates its operation. Watching a mailing list macro assemble and format an address label from a

VIRGINIA PECK

database is impressive enough, but it is even more so after you understand how the macro works.

The first lesson presented in the menu section covers the {GET}, {GETLABEL}, {IF}, and {BRANCH} macro commands. It shows you how to create simple menus, self-editing macros, and more. The printing section covers the use of borders, headers and footers, embedded codes, and setup strings, as well as common output problems, the creation of print macros, and other printing tips. The database section presents lessons on *1-2-3* database structure, sorting, Criterion ranges, input macros, label printing, and the use of *Lotus HAL* to build a database. Written by Technojock Software's Bob Ainsbury, this shareware package ($10 requested) is available on PsL disk #795 or as the file TUTOR.ARC in Data Library 4 on the World of Lotus.

HOME MANAGEMENT SYSTEM ($10 requested) is a program you might easily overlook if you believe that applications like computerized checkbooks are more trouble than they are worth. Once you realize that the program's checkbook, household inventory, loan analyzer, and utility-bill-tracking templates are teaching tools, you begin to view this package in an entirely different light. These simple applications actually teach you how to use *1-2-3* and *Symphony*. This program, also written by Ainsbury, is available on PsL disk #1255 or as HOMEMG.ARC in Data Library 11 on the World of Lotus.

BEGINNING CLASS and **ADVANCED CLASS** disks, by Patrick Magee, are also useful. The author, a *1-2-3* enthusiast and expert, created these programs when he headed the Pacific Northwest Lotus Users Group. The worksheets and macros deal almost exclusively with financial applications and are designed as aids for anyone who wants to teach or learn *1-2-3*. These disks (#163 and #164, respectively; $20 per disk requested) are available from the PsL.

LOTUS HELP FILES, **LOTUS NOTEBOOK**, and **123/SYMPHONY TECH NOTES** are PsL disk collections of text files (disks #16, #773, and #170, respectively) containing a wealth of *1-2-3*– and *Symphony*-related information. Included are Lotus press releases and product descriptions, user-contributed case studies, lists of user groups, and useful tips and techniques. You can find most of these files, free of charge, in Data Library 2 on the World of Lotus.

UTILITY AND ADD-IN PROGRAMS

LOTUS SPEEDUP and **LOTUS LEARN** are probably the two most important add-ins you can have. Both were created by Lotus Development Corp. and are available free of charge. *Lotus Speedup* requires *1-2-3* Release 2.01 and, true to its name, speeds up the recalculation of most worksheets by limiting recalculation to those cells with formulas whose values have changed and to the cells that depend upon them. The *Lotus Learn* program makes it easy to create macros in *1-2-3* Release 2/2.01 by recording your keystrokes for playback as a macro. Both add-ins require the Lotus Add-In Manager, which is supplied with these two programs.

EDNAME.ADN (**EDNAME.ARC** on CompuServe), a shareware program ($12.95 requested) by Gerald Lerman, is another useful tool. When you edit a formula that contains range names, *1-2-3* normally displays cell coordinates instead of range names. With *Edname*, however, you can toggle back and forth between a cell-coordinate display and a range-name display.

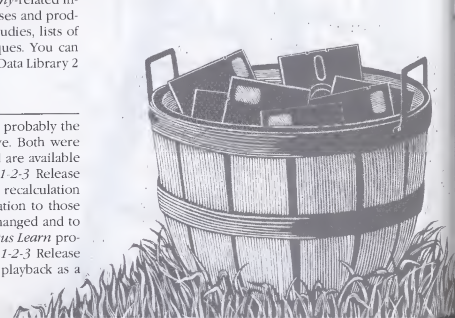
ENTER.ADN, a public domain program from Todd Roseman (no fee requested), offers another convenient feature. When this program is activated, it inserts a label prefix before every keyboard entry. You specify which prefix you want and thereby decide the label alignment. The program can be turned on and off, so you can switch quickly back and forth between normal entry and label-prefix entry.

You can find all four of these add-ins, plus the Add-In Manager, on PsL disk *123 Add-Ins #1* (disk #1080) or in Data Library 4 on the World of Lotus.

@LAST is a shareware add-in ($28 requested) that adds a search-and-replace feature to *1-2-3* and operates on values, labels, and formulas. *@LAST* can locate and, if instructed, replace cell contents. You can make a wild-card search for labels or formulas. Possible uses for this program include realignment of labels, correction of consistently misspelled labels, or replacement of repetitive cell entries. *@LAST* can be found on PsL disk *123 Add-Ins #2* (disk #1080-2).

GRAPHICS PROGRAMS

Exploring further in the world of public domain software, you will find programs that help you change the display colors used by *1-2-3* and *Symphony* and programs that replace the Lotus International Character Set (LICS) with IBM or ASCII characters. With these tools you can create special graphics effects, as well as use a variety of otherwise inaccessible symbols in your work-



sheets. The following are two programs to look for.

ENHANCER is a shareware package ($35 requested) that allows you to change the colors of *1-2-3* and *Symphony* screens. It displays a worksheet component, for example the cursor or the WAIT indicator, and allows you to scroll through all possible color options. When you find the color you like, you move to the next component. When all screen elements are displayed in your favorite colors, you press the END key to instruct *Enhancer* to modify your *1-2-3* or *Symphony* driver set. *Enhancer*, written by Ivor B. Miller, is available as ENHNCR.ARC in Data Library 3 on the World of Lotus.

WIDE.APP and **MCA.APP** are of particular interest to *Symphony* users. WIDE.APP allows you to import structured ASCII files that have lines longer than 240 characters. MCA.APP is the macro-conversion aid created by Lotus Development Corp. to convert *1-2-3* Release 1 and 1A macros into the equivalent command language keyword in *Symphony*. Both files reside in Data Library 6 on the World of Lotus and on PsL disk #158, *Symphony Add-Ons*.

FINANCE, INVESTMENT, AND BUSINESS PROGRAMS

The best way to locate finance and investment software is to order the PsL Lotus Catalog (disk #992) mentioned earlier and review the one-line descriptions of each file. You will find templates to handle calculations such as discounted cash flow, internal rate of return, financial ratios, nonlinear break-even analysis, and monthly amortization schedules. Other highlights include worksheets that calculate stock options, track bond prices, and analyze rental income property. The following programs deserve particular attention.

STOCKTRACKER, which works with *1-2-3* Releases 1A and 2.01 only, is a portfolio for investors who track stock performance. This PsL shareware program (disk #1358; $39.95 requested) uses historical stock data that you enter or import. You can compare a stock's performance the first quarter of this year with its performance the first quarter of last year, or you can compare a stock against the Dow Jones Industrial Average over a particular time period. A number of sophisticated graphs are built into the program, one of which illustrates a net percent annualized return. According to Wendell Loupe, the program's author, this graph is useful in determining the most advantageous time to sell a stock.

123 CASH FLOW PROJECTION, **123 CASH FLOW LEDGER**, and **SYMPHONY CASH FLOW PROJECTION**, by Patrick Magee, are useful if you operate a small business. These PsL programs (disks #165, #166, and #186, respectively; $20 per disk requested) help you develop a five-year plan and a cash flow analysis for your business.

BUSINESS TOOLS is a series of programs on three PsL disks (#151, #152, and #114). Included are programs for creating Gantt charts, inventory tracking, simple project management, cost-distribution analysis, professional billing, payroll, and scheduling.

The programs mentioned so far just scratch the surface of what's available. The PsL and the World of Lotus also offer utility macros for *1-2-3* and *Symphony*, programming tools, tax templates, and graphics demonstration programs. To expand your public domain and shareware search beyond these sources, join a user group and seek the counsel of its Lotus librarian. You might also ask members of the World of Lotus on CompuServe for advice on the best files to download for a given application. ■

IN BRIEF

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American PeopleLink, 165 North Canal St., Suite 950, One Northwestern Center, Chicago, IL 60606; 800-524-0100, in Ill. and Canada 312-648-0660.
Byte Information Exchange (BIX), One Phoenix Mill Lane, Peterborough, NH 03458-9990; 800-227-2983, in N.H. 603-924-7681.
World of Lotus, CompuServe Information Service, 5000 Arlington Centre Blvd., Columbus, OH 43220; 800-848-8199, in Ohio and Canada 614-457-0802.
Delphi, General Videotex Corp., 3 Blackstone St., Cambridge, MA 02139; 800-544-4005, in Mass. 617-491-3393.
GEnie Information Services, 401 North Washington St., Rockville, MD 20850; 800-638-9636.
The Source, 1616 Anderson Rd., McLean, VA 22101; 800-336-3330, in Va. 703-821-8888.

Mail-Order Houses

PC-SIG, 1030D East Duane Ave., Sunnyvale, CA 94086; 800-245-6717, in Calif. 800-222-2996. Catalog: PC-SIG Library, 4th edition; a 425-page paperback, covering the first 705 disks in the library. PC-SIG Supplement, a 220-page paperback, covering disks #706 to #1124. Available in book stores or directly from PC-SIG. Mail order cost is $12.95 for catalog, $8.95 for supplement, plus $4 shipping and handling. The entire PC-SIG library is available on CD-ROM for $295. PC-SIG also sells CD-ROM readers. PC-SIG's Canadian Distributor: Canada Remote Systems, 4198 Dundas St. W., Toronto, Ontario M8X 1Y6; 416-231-2383; in Nfld., Man., Sask., Alta., B.C. 800-268-2705; in N.S., P.E.I., N.B., Que., Ont. 800-387-1901.
Public Brand Software, P.O. Box 51315, Indianapolis, IN 46251; 800-426-3475, in Ind. 317-856-7571. Catalog: The Shareware Catalog and Reference Guide, complete 80-page catalog is published four times a year; free for the asking.
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@FUNCTIONS
Revisited

BY RICHARD CRANFORD

When you build a spreadsheet model, you may occasionally create extra work for yourself. For example, you might write labyrinthine @IF formulas that could be more concise and memory-efficient. Or perhaps you create untrustworthy formulas that, under certain circumstances, fill your model with ERR and NA messages. You may even use a series of formulas to perform a task better accomplished by a simple @function. This extra work often occurs because you aren't familiar enough with how the @functions work and what they can do.

To ease your work load, reacquaint yourself with some of the @functions—namely, @IF, @CELL, @ROUND, @VAR, @ISERR, @ISNA, @ISSTRING, and @ISNUMBER. You'll discover not only little-known features but also some good uses for them. With just a few exceptions, which we'll note, these techniques work in all releases of *1-2-3* and *Symphony*.

BRUSH UP ON THE @FUNCTIONS. YOU MAY FIND SOME NEW SOLUTIONS TO OLD PROBLEMS.

PRUNE YOUR @IF FORMULAS

Are your @IF formulas the mathematical equivalents of properly constructed English sentences? If so, your formulas may be longer and use more memory than necessary. For example, suppose you need a formula to evaluate the contents of cell C1. If cell C1 contains the value 100, the formula returns the sum of cells A1, A2, and A3. If cell C1 is blank or if it contains any entry other than the value 100, the formula returns the sum of cells A1, A2, and B3. You might write this formula:

@IF(C1 = 100,A1 + A2 + A3,A1 + A2 + B3)

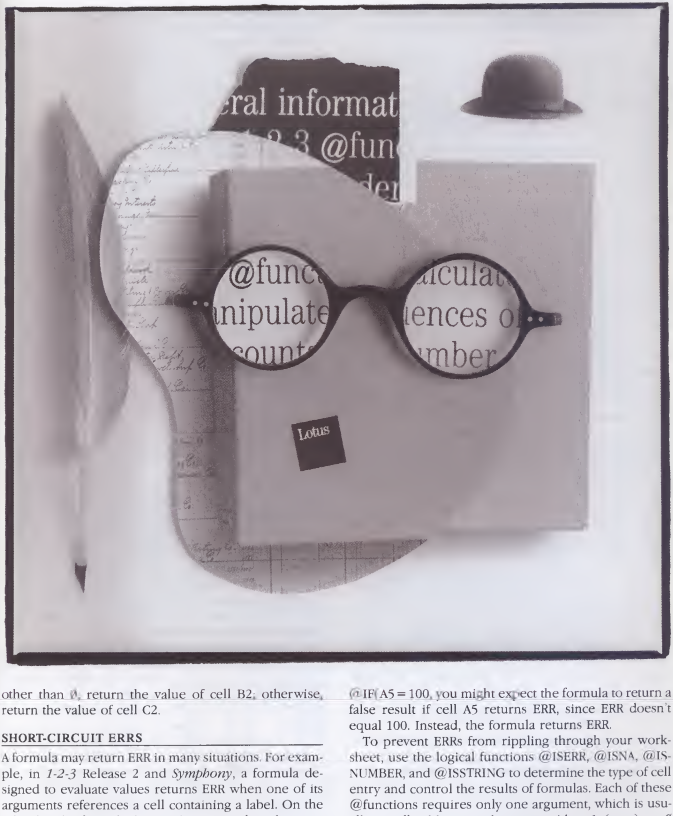
Notice that the true and false arguments contain the common expression A1 + A2. To shorten the formula, move the common expression out of the @IF portion of the formula and restate it as follows:

+ A1 + A2 + @IF(C1 = 100,A3,B3)

Read the formula to yourself: A1 plus A2 plus if C1 equals 100, then A3; otherwise, B3. At first glance, the second formula, which doesn't flow as smoothly as the first, may perplex you. Fortunately, computers and software aren't as fussy as you are. Both formulas work, but the second one uses less memory. In fact, if the common expression were longer, the difference in the formula's length and memory requirements would be more dramatic. Therefore, look for and excise duplicate expressions from the second and third arguments of your @IF functions.

Another pruning technique applies to @IF functions that test whether a value is not equal to zero, or <>0. If that's what you're testing for, the first argument, or test, doesn't require the expression <>0. You may be familiar with a formula like @IF(A2<>0,B2,C2). However, consider the alternative formula, @IF(A2,B2,C2).

Read the formula and you may begin to wonder, If A2...what? This formula says that if cell A2 contains a value other than 0 or a formula that returns a value



other than 0, return the value of cell B2; otherwise, return the value of cell C2.

SHORT-CIRCUIT ERRS

A formula may return ERR in many situations. For example, in *1-2-3* Release 2 and *Symphony*, a formula designed to evaluate values returns ERR when one of its arguments references a cell containing a label. On the other hand, a formula designed to manipulate character strings goes into a tailspin upon encountering a cell that contains a value. Furthermore, a cell containing either @ERR, @NA, or a formula that returns ERR or NA can cause any formula that relies on it to return ERR or NA. For example, if you begin a formula with @IF(A5 = 100, you might expect the formula to return a false result if cell A5 returns ERR, since ERR doesn't equal 100. Instead, the formula returns ERR.

To prevent ERRs from rippling through your worksheet, use the logical functions @ISERR, @ISNA, @ISNUMBER, and @ISSTRING to determine the type of cell entry and control the results of formulas. Each of these @functions requires only one argument, which is usually a cell address, and returns either 1 (true) or 0 (false). If you specify a multiple-cell range address or range name, the function returns the result of the upper-left cell of the range. (Note that @ISSTRING and @ISNUMBER are not available in *1-2-3* Release 1A.)

Here's what the four functions do:

GEOF KERN

@ISERR(A1) returns 1 if cell A1 contains @ERR or if the result of the formula in cell A1 is ERR; otherwise, it returns 0.

@ISNA(A1) returns 1 if cell A1 contains @NA or if the result of the formula in cell A1 is NA; otherwise, it returns 0.

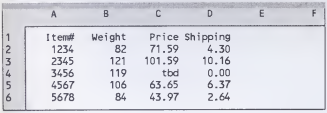
@ISSTRING(A1) returns 1 if cell A1 contains either a label or a formula that returns a character string; otherwise, it returns 0.

@ISNUMBER(A1) returns 1 if cell A1 is blank or if it contains a number or a formula that returns a value; otherwise, it returns 0.

TRY OUT @ISNUMBER AND @ISERR

You might wonder why @ISNUMBER treats a blank cell as though it contained a value. Remember that when used as a single argument in an @function, a blank cell has the value 0. Therefore, when you use @ISNUMBER to evaluate a blank cell, it returns 1 to signal that it's OK to use the cell in a mathematical formula.

Let's look at how you might use @ISNUMBER. The following figure contains the first five records of a large database. The field named *Shipping* calculates the shipping charges based on the weight of an item. If the item weighs less than 100 pounds, you charge an additional 6% of the item's price. If the item weighs more than 100 pounds, you charge 10% of the item's price.



```
        A         B          C        D         E         F
1     Item#    Weight      Price Shipping
2     1234         82      71.59     4.30
3     2345        121     101.59    10.16
4     3456        119        tbd     0.00
5     4567        106      63.65     6.37
6     5678         84      43.97     2.64
```

If you use *1-2-3* Release 2 or *Symphony*, perhaps you can anticipate the problem here. If the *Price* column contained only values, you could enter the formula +C2*@IF(B2<100,.06,.1) in cell D2 and copy it down column D. Because cell C4, and probably other cells in column C, contains the label *tbd*, meaning "to be determined," you need an alternative approach to calculating the shipping cost. The @IF formula mentioned won't work, since it returns ERR in the *Shipping* field of any records containing *tbd* in the *Price* field. All those ERRs prevent your using an @SUM formula to total the column of shipping charges or using the statistical @functions to select and evaluate values from the database.

The solution is to use @ISNUMBER to force the formulas in column D to return 0 whenever the corresponding entries in column C are labels. The following formula, entered in cell D2 and copied down the column, does the trick:

@IF(@ISNUMBER(C2),C2*@IF(B2<100,.06,.1),0)

Remember, since the @ISNUMBER function returns either 1 or 0, you need not begin the formula with @IF(@ISNUMBER(C2)=1.

@ISNUMBER works in cases where you need to determine whether a cell contains a label or a value. However, sometimes you need to find out whether a cell is blank or contains a value. For this task, use the @CELL function, which returns information about the attributes of a given cell. (Note that this @function is not available in *1-2-3* Release 1A.) @CELL takes two arguments: a character string that describes the cell attribute you want to evaluate and a range. You can test for nine different cell attributes. For our purposes, we'll focus on the *type* attribute, which indicates whether a cell is blank or whether it contains a value, which can take the form of a numeric value, a formula, a string-returning formula, or a label. Consider the following example:

@CELL("type",A1..A1)

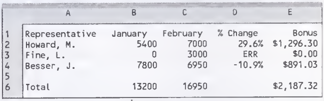
The formula returns the string *b* if cell A1 is blank, *v* if it contains a value or formula, or *l* if it contains a label. Note that the second argument must be a single-cell range, which you enter in the traditional manner as A1..A1 or in spreadsheet shorthand as !A1. For example, if you specify the multiple-cell range A1..C10, @CELL returns a string that is based on the contents of the cell in the upper-left corner of that range, which in this case is cell A1.

You might use @CELL in conjunction with @IF to ensure that a cell required in an @IF formula contains a value. For example:

@IF(@CELL("type",A1..A1)="v",A1+B1,@ERR)

The formula returns ERR if cell A1 is blank or if it contains a label. You could use this formula if you want to ensure that zeros, not blank cells indicating zeros, appear in column A.

Now consider the logical function @ISERR. The following figure contains a small sales report that lists sales representatives, sales totals for two months, percentage changes in sales, and bonuses.



```
          A              B         C         D           E
1  Representative    January   February  % Change      Bonus
2  Howard, M.           5400      7000     29.6%   $1,296.30
3  Fine, L.                0      3000      ERR        $0.00
4  Besser, J.           7800      6950    -10.9%     $891.03
5
6  Total               13200     16950             $2,187.32
```

Columns B and C contain values. Cell D2 contains the formula (C2 – B2)/B2, which has been copied to range D3..D4. This formula calculates the percentage of change in sales totals from January to February.

Notice that the formula in cell D3 returns ERR. This occurs because the formula is trying to divide by 0, a practice that is mathematically invalid. To correct this condition, you might use an @IF expression to force the formula to return 0 whenever the value in the *January* field is 0. However, because 0 is also the result you get if a sales representative sells the same amount in two consecutive months, you need a different solution.

Column E contains a formula that computes bonuses. The company calculates each representative's monthly bonus by increasing or decreasing a base bonus of $1,000, depending on the percentage of change in sales from month to month. You might use the formula 1000*(1+D2), which produces the correct results for cells E2 and E4. But cell D3 returns ERR, since the formula is trying to add 1 to ERR, the current contents of cell D2. Since the company's policy is to award no bonus for the first month of sales, use this formula to calculate the correct bonus under all conditions:

1000*@IF(@ISERR(D2),0,1+D2)

The formula says: If the contents of cell D2 is ERR, enter 0 in cell E2; otherwise, multiply 1,000 by 1 plus the contents of cell D2. Although you may be willing to have ERRs pop up in column D, using the @ISERR function prevents dependent formulas in column E from returning ERRs.

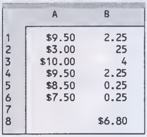
GET BACK TO BASICS

People often construct convoluted models to perform tasks that a simple @function could accomplish. The problem is that either they don't know that an @function exists, or if they do, they're not aware of its helpful features. Take a look at two examples that illustrate this problem. One involves the @VAR function; the other, @ROUND.

Imagine that you need to calculate the variance of a series of values. You know that to calculate a population variance, you subtract the mean of the values from each value in the series, square each difference, total the squares, then divide by the number of values in the series. To calculate a sample variance, follow the same process, but divide the sum of the squares by a number that is one less than the number of values in the series.

If your basic tools are a calculator and a scratch pad, computing a variance is tedious. With a spreadsheet, the task is less tiresome. Suppose you need to calculate the variance for the values in range A1..A6 of the following figure.

First, enter the formula (A1 – @AVG(A$1..A$6))^2 in cell B1, and copy that cell to range B2..B6. Each formula subtracts from the cell to its left the average of the values in range A1..A6 and then raises each result to the power of 2.



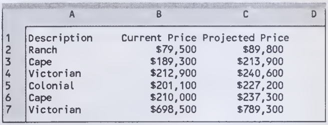
	A	B
1	$9.50	2.25
2	$3.00	25
3	$10.00	4
4	$9.50	2.25
5	$8.50	0.25
6	$7.50	0.25
7		
8		$6.80

Since the values in column A represent a sample, enter the formula @SUM(B1..B6)/((@COUNT(B1..B6) – 1)) in cell B8 to calculate the variance of the values in range A1..A6.

If you were more familiar with the @functions, you would not use this method to perform the analysis. A far simpler approach is to use the @VAR function, which finds the differences and then squares and averages the values in a list. To return a population variance, use the formula @VAR(A1..A6). To adjust the function to calculate a sample variance, use this formula:

@VAR(A1..A6)*(@COUNT(A1..A6)/
(@COUNT(A1..A6) – 1))

Now consider another problem that you can solve by using a little-known feature of the @ROUND function—namely, its ability to accept a negative value for the decimal-place argument. Suppose you want to evaluate the effect of a projected 13% increase in property values. Your worksheet, shown below, contains a representative sample of properties, current prices, and future prices that reflect the projected increase.



	A	B	C	D
1	Description	Current Price	Projected Price	
2	Ranch	$79,500	$89,800	
3	Cape	$189,300	$213,900	
4	Victorian	$212,900	$240,600	
5	Colonial	$201,100	$227,200	
6	Cape	$210,000	$237,300	
7	Victorian	$698,500	$789,300	

What formula would you use to round off the projected prices, shown in column C, to the nearest 100 dollars? Your first inclination might be to enter the following formula into cell C2 and copy it down the column:

@ROUND(B2*1.13/100,0)*100

Follow the logic of this formula. Multiplying 79,500 by 1.13 returns 89,835, which returns 898.35 when divided by 100. Rounding 898.35 to zero decimal places returns 898, which returns the desired result, 89,800, when multiplied by 100.

The formula does the job, but there is an easier solution. When you need to round to the left of the decimal point, use a negative value for the decimal-place argument in the @ROUND function. Rounding to –1 decimal places rounds to the nearest 10, while rounding to –2 decimal places rounds to the nearest 100. So a simpler formula that calculates property values rounded to the nearest 100 dollars is:

@ROUND(B2*1.13, –2)

The message is: Reread the documentation. You'll discover @functions that you previously overlooked, as well as little-known features that make the functions even more valuable. And be prepared for a few surprises. For example, did you know that even the lowly @SUM function has a hidden feature? @SUM doesn't require a continuous range. The formula @SUM (A1..A5,A9,A15..A20) is a simple variation of @SUM (A1..A5)+A9+@SUM(A15..A20). ■

Richard Cranford is LOTUS*'s assistant editor for departments.*

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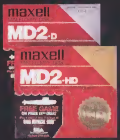

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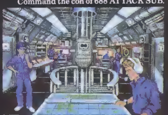

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THE GOLD STANDARD

RE-CREATE REALITY IN A SPREADSHEET

Use @RAND to anticipate business activity, from customer load to staffing levels.

BY RICHARD C. GENIS

If we knew with certainty what the outcome of an action would be, deciding whether or not to take the action would be simple. The decision would depend solely upon the favorability of the outcome. But in most cases, neither the outcome nor the factors affecting outcome are certain. Often, several conditions affect the results. Since *1-2-3* and *Symphony* can generate random numbers, you can create a spreadsheet that simulates these conditions and shows the various outcomes.

To understand how unpredictable factors bear on results, consider the problem of staffing an information desk. The appropriate staffing level is a function of the number of customers arriving daily, the interval between arrivals, and the amount of time required to serve each customer. If you simulate each of these variables, you can get enough information to make informed staffing decisions.

Here are two more examples:

The appropriate number of on-duty nurses in a hospital ward depends on the number of patients in the ward at the time. But the number of patients varies from day to day with no definable pattern. By simulating the number of patients, the head nurse can make more informed staffing decisions.

A manufacturing firm that experiences changeable demand for its product can simulate inventory changes and thereby predict how often stock will run out. Based on this, the firm can decide if it needs to step up production.

To make more effective decisions, you can create simulations of random occurrences. Once you gather the facts and develop a model, you can experiment with alternative courses of action until you arrive at the one that's likely to yield the most favorable outcome.

Follow these six steps to create a simulation: define the problem, collect data, establish probability ranges, create a simulation table, run the model, and evaluate the results. Let's look at these steps and see how they relate to a hypothetical problem. Along the way, we'll learn about the workings of a spreadsheet-based simulation. You can follow the instructions in the box on page 62 to create the worksheet. Remember that the results of the formulas won't match the values shown in figure 2 because each calcu-

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ROB SAUNDERS

lation of the spreadsheet produces different random numbers.

WHAT TO DO WITH ALL THESE TOURISTS

Step 1: Define the problem. Joan Brindle is the director of tourism for the town of Nifty Valley. Visitors to Nifty Valley often stop at the Tourist Information Center to ask questions, pick up maps and brochures, and so forth. A representative of the Nifty Valley Tourist Bureau helps visitors during business hours.

Visitors arrive at the information center at various times of the day and at various intervals. If more than one visitor is in the center at once, some must wait in line. Joan has two objectives. She wants her staff to serve visitors quickly so that they don't wait in line long, and she wants to use the representative's time effectively. Joan thinks that keeping a visitor waiting 45 seconds or less is acceptable and that using 80% or more of the representative's on-duty time is a good use of resources. How well are these goals being met?

After the first visitor of the day arrives, one of two things happens: Either the visitor leaves before the next visitor shows up, or the next visitor shows up before the previous one is finished. In the first scenario, the Tourist Bureau representative has idle time. In the second scenario, the subsequent visitor has to wait in line. The amount of idle time the representative experiences determines the representative's utilization. The amount of time each visitor must wait determines the average waiting time at the information center.

Step 2: Collect data. Joan recorded the intervals between visitors' arrivals for a week. She also recorded the time it took to serve each visitor. For simplicity, she rounded the times to the nearest minute. She found that the interval between arrivals varied from three to seven minutes and that the service time varied from three to six minutes. In practice, times would vary much more than this. We'll use these ranges to keep our illustration simple. This information is recorded in the portion of the spreadsheet shown in figure 1. Columns A and B are reserved for the observed data. Range A7..B11 shows that during the week 181 visitors arrived three minutes after the arrival of the previous visitor, 77 arrived four minutes later, and so on. Range A17..B20 shows that 117 visitors required three minutes of service, 215 required four minutes, and so on.

Step 3: Establish probability ranges. Joan infers that the percentage of visitors who arrived at a given interval after the previous visitor is equal to the probability that a visitor will arrive at that interval in the future. So each formula in range C7..C11 divides the value to its left by the sum of the values in range B7..B11. Thus there is a 24.1% chance of a visitor arriving three minutes after the previous visitor, a 10.3% chance of a visitor arriving four minutes later, and so forth. The formulas in range C17..C20 calculate the

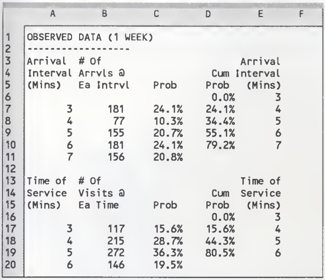
NUMBERS IN A HAT

Joan, Nifty Valley's director of tourism, wants to make sure the Tourist Bureau is staffed at the appropriate level. Her objectives are to serve visitors quickly and to make good use of the Tourist Bureau representative's time. The staffing level depends on the number of customers arriving daily, the interval between arrivals, and the time required to serve each customer. If Joan simulates each of these variables, she'll get enough information to make her decision.

In the days before computers, Joan would have had to create a simulation using some device for producing random numbers, such as a hat containing slips of paper numbered from 0 to 99, which would represent probabilities of 0% to 99%. After determining the probabilities associated with possible service times and arrival intervals, she'd pull a slip out of the hat. If its number fell between 0 and 16, she'd decide that the first visit took three minutes. If its number fell between 17 and 44, the first visit took four minutes, and so on. Then she'd put the slip back and pull again. Next time, if the number fell between 0 and 24, the second visitor arrived three minutes after the first. If it fell between 25 and 34, the second visitor arrived four minutes after the first, and so on. Then she'd replace the slip and pull again to determine the service time of the second visitor. She'd repeat the process until she developed a set of random arrival intervals and service times for 15 visitors.

Computer software eliminates the need for such devices. In particular, *1-2-3* and *Symphony* provide the function @RAND, which returns a fractional number between 0 and 1, noninclusive. These numbers can be used to represent probabilities, but there will be many more than the 100 possibilities you'd get with the pieces of paper in the hat. The number will be different in every cell that contains the @RAND function, and the number changes every time you press the CALC key. If you set recalculation to automatic, the numbers also will change when you make or change a cell entry.

If you use *1-2-3* Release 1A or *Symphony* Release 1/1.01, be aware that these products do not produce true random numbers. In these early releases, @RAND returns the same values in the same sequence every time you start the program. To make your sequences somewhat less predictable, press the CALC key several times before creating a simulation table or retrieving an existing one. This will cause your software to return random numbers from a point farther along in the sequence.



	A	B	C	D	E	F
1	OBSERVED DATA (1 WEEK)					
2	------------------					
3	Arrival	# Of			Arrival	
4	Interval	Arrvls @		Cum	Interval	
5	(Mins)	Ea Intrvl	Prob	Prob	(Mins)	
6				0.0%	3	
7	3	181	24.1%	24.1%	4	
8	4	77	10.3%	34.4%	5	
9	5	155	20.7%	55.1%	6	
10	6	181	24.1%	79.2%	7	
11	7	156	20.8%			
12						
13	Time of	# Of			Time of	
14	Service	Visits @		Cum	Service	
15	(Mins)	Ea Time	Prob	Prob	(Mins)	
16				0.0%	3	
17	3	117	15.6%	15.6%	4	
18	4	215	28.7%	44.3%	5	
19	5	272	36.3%	80.5%	6	
20	6	146	19.5%			

FIGURE 1. Observations of 750 visitors to an information center produced the values entered in columns A and B. The formulas in column C determine the probabilities for the various arrival intervals and service times by dividing the number of observations at each value by the total number of observations. For example, since 24.1% of visitors arrived three minutes after the previous visitor, the probability is 24.1% that future visitors will arrive three minutes after previous visitors. The cumulative probabilities and listings of outcomes in columns D and E are used as lookup tables by formulas elsewhere in the worksheet.

probabilities associated with the time a visit may take.

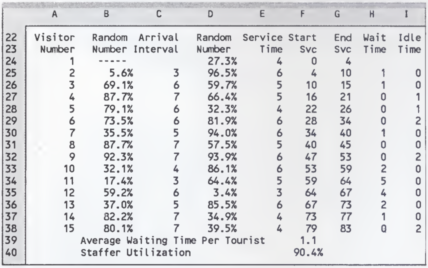
Formulas in column D of figure 1 calculate the cumulative probabilities. These values are used as the lookup columns in @VLOOKUP formulas in the portion of the worksheet shown in figure 2. The value 0 is entered in cells D6 and D16 to act as the first value in each table.

After establishing the probability ranges, Joan arranges the possible arrival intervals and service times in column E. Note that in figure 1, the ranges of arrival intervals and service times in column E begins one row up from the corresponding values in column A. The reason is that the simulation involves producing random numbers. If the first random number falls between 0 and 24.1, Joan will say that the second visitor arrives three minutes after the first. She therefore places the 3 next to the 0 in cell D6. Now Joan is ready to simulate activity at the information desk and see if she's likely to meet her objectives over time.

Step 4: Create a simulation table. The table in figure 2 calculates possible waiting times and employee utilization for a block of 15 consecutive visitors. Remember that this is a simplified illustration. In practice, a simulation table should include 50 or even 100 rows. Column B contains formulas that generate random numbers using the @RAND function. Read the NUMBERS IN A HAT box for more on the @RAND function. Column C contains formulas that look up the numbers in column B in the range of cumulative arrival-interval probabilities (range D6..D10) and return the intervals associated with those numbers. Cell B25, for example, currently returns 0.0558999574, although the cell displays 5.6%. This is greater than the value in cell D6 (0.0%) but less than the value in cell D7 (24.1%), so cell C25 returns 3, the value in cell E6. Since there's a 24.1% chance of the @RAND function in cell B25 returning a value between 0 and .241, there is a 24.1% chance that the @VLOOKUP formula in cell C25 will indicate that the second visitor arrives three minutes after the first. Considered as a whole, the formulas in column C describe a plausible scenario in which the second visitor arrives about three minutes after the first, the third arrives about six minutes after the second, and so on.

Column D contains another set of random-number-returning formulas, and column E contains formulas that look up these numbers in the cumulative service-time probabilities (range D16..D19) and return the times associated with the numbers. Since cell D24 currently returns 0.2728635729 (displayed as 27.3%), cell E24 returns 4. The formulas in column E describe a scenario in which the first visit takes four minutes, the second visit takes six minutes, and so on.

Column F's formulas determine how many minutes elapse between the arrival of one visitor and the start of the next visitor's service. Column G's formulas determine how many minutes elapse until the end of each visitor's service. The values in columns F and G are not



	A	B	C	D	E	F	G	H	I
22	Visitor	Random	Arrival	Random	Service	Start	End	Wait	Idle
23	Number	Number	Interval	Number	Time	Svc	Svc	Time	Time
24	1	-----		27.3%	4	0	4		
25	2	5.6%	3	96.5%	6	4	10	1	0
26	3	69.1%	6	59.7%	5	10	15	1	0
27	4	87.7%	7	66.4%	5	16	21	0	1
28	5	79.1%	6	32.3%	4	22	26	0	1
29	6	73.5%	6	81.9%	6	28	34	0	2
30	7	35.5%	5	94.0%	6	34	40	1	0
31	8	87.7%	7	57.5%	5	40	45	0	0
32	9	92.3%	7	93.9%	6	47	53	0	2
33	10	32.1%	4	86.1%	6	53	59	2	0
34	11	17.4%	3	64.4%	5	59	64	5	0
35	12	59.2%	6	3.4%	3	64	67	4	0
36	13	37.0%	5	85.5%	6	67	73	2	0
37	14	82.2%	7	34.9%	4	73	77	1	0
38	15	80.1%	7	39.5%	4	79	83	0	2
39		Average Waiting Time Per Tourist				1.1			
40		Staffer Utilization				90.4%			

FIGURE 2. This table uses random numbers (columns B and D) and @VLOOKUP formulas (columns C and E) to create possible arrival intervals and service times for 15 visitors to the information center. Additional formulas calculate waiting times for visitors and idle times for Tourist Bureau representatives. The formulas in cells F39 and F40 calculate average waiting time and staff utilization. Pressing the CALC key produces a new set of random numbers and, therefore, a new simulation.

HOW TO SET UP THE WORKSHEET

1. Default settings
Set recalculation to manual. In *1-2-3* press slash and select Worksheet Global Recalculation Manual. In *Symphony* press MENU and select Settings Recalculation Method Manual Quit.

2. Column widths and range formats
Set the width of columns F through I to 7: Move the cell pointer to each column, select /Worksheet Column Set-Width (in *Symphony*, MENU Width Set), and enter 7.

Format several cells or ranges to show percents with one decimal place. Select /Range Format Percent (in *Symphony*, MENU Format %), enter *1*, and specify the appropriate cell or range. Use these ranges: D6, C7..D7, D16, C17..D17, B25, D25, and F40. Then assign the Fixed format with one decimal place to cell F39.

3. Labels
Enter all the labels shown in figures 1 and 2. Create the dashed lines in range A2..B2 by entering backslash hyphen (\-). Create the label in cell B24 by entering a quotation mark and five hyphens ("-----). Right-align blocks of labels by selecting /Range Label Right (in *Symphony*, Menu Range Label-Alignment Right) and specifying the appropriate range. Use these ranges: C3..E5, C13..E15, and A22..I23.

4. Values
Enter the values shown in columns A, B, and E of figure 1. Enter the values 1 through 15 in range A24..A38: Select /Data Fill (in *Symphony*, MENU Range Fill), specify A24..A38 as the Fill range, enter *1* as the start value, and press Return twice to accept the default step and stop values. Enter *0* in cells D6, D16, and F24.

5. Enter and copy formulas

Cell **Formula**
C7 +B7/@SUM(B$7..B$11)
Copy cell C7 to range C8..C11.

D7 @SUM($C$7..C7)
Copy cell D7 to range D8..D10.

C17 +B17/@SUM(B$17..B$20)
Copy cell C17 to range C18..C20.

D17 @SUM($C$17..C17)
Copy cell D17 to range D18..D19.

B25 @RAND
C25 @VLOOKUP(B25,D$6..E$10,1)
D25 @RAND
E25 @VLOOKUP(D25,D$16..E$19,1)
F25 @MAX(G24,@SUM(C$25..C25))
G25 +F25+E25
H25 @MAX(G24-@SUM(C$25..C25),0)
I25 @MAX(@SUM(C$25..C25)-G24,0)
Copy range B25..I25 to range B26..B38.
Copy range D25..E25 to cell D24.
Copy cell G25 to cell G24.

F39 @SUM(H25..H38)/@COUNT(A24..A38)
F40 (G38-@SUM(I25..I38))/G38

important by themselves, but they are necessary for calculating the values in column H and I.

Column H's formulas calculate the number of minutes each visitor has to wait. They use the @MAX function to keep them from returning values less than 0, since a visitor can't wait a negative amount of time. Finally, column I's formulas calculate the number of minutes the Tourist Bureau representative is idle until the arrival of the next visitor. Again, the @MAX function keeps the formulas from returning negative values.

The formula in cell F39 indicates that these 15 visitors will have an average waiting time of 1.1 minutes. The formula in cell F40 indicates that the Tourist Bureau representative is working 90.4% of the time from the arrival of the first visitor to the departure of the last.

Step 5: Run the model. To develop values that are likely to reflect what she'll experience over time, Joan runs the model several times. Running the model is simply a matter of pressing the CALC key. She records the results and notes the number of times the model meets her objectives. As mentioned earlier, Joan wants to have a waiting time of 45 seconds (.75 minutes) or less and staffer utilization of 80% or better. In 100 test runs of the model, it met the first objective less than 50% of the time and met the second objective more than 80% of the time. Of course, since the model generates random numbers, you can't predict the results.

Step 6: Evaluate the results. These results indicate that while Joan should be satisfied with the utilization of the Tourist Bureau representatives, the amount of time some visitors are kept waiting is unacceptable. The correction for this problem may be as simple as adding a self-service rack to allow visitors who need only maps or brochures to help themselves. To be sure of reducing waiting times, Joan may have to employ a second representative. This, however, would probably reduce the utilization of both representatives.

If the results indicated that the representatives were experiencing too much idle time, Joan could remedy that problem by finding additional duties for them, such as sending out responses to mail requests.

You can simulate a variety of situations by using the techniques we've used here. Start with possible outcomes and determine the probabilities associated with each, based on the percentage of times those outcomes have occurred in the past. Then create random numbers, and for each one, determine an outcome based on the range the random number falls into. Although a simulation isn't a crystal ball, you can use it to determine what *could* happen in the future. ■

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Q&A

ANSWERS TO YOUR QUESTIONS ABOUT LOTUS PRODUCTS

1-2-3

DATA QUERY RANGE MIX-UP

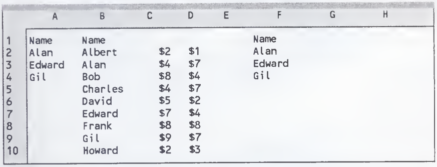
Q. I am having a problem with the Data Query commands. The Criterion range contains a great deal of information entered across 15 cells. How can I get the Extract function to produce not only the Criterion cell but also the adjoining information? The following is a sample of my spreadsheet [figure 1] after I use the Data Query Extract command. Range A1..A4 is defined as the Input range, B1..D10 is the Criterion range, and F1..F1 is the Output range.

Alan Landsburg
The Landsburg Co
Los Angeles, Calif

A. You're on the right track, but you've mixed up your ranges. The first row of the Input range should contain field names, and the second row should contain the first record. The subsequent rows should contain all the associated data; the Input range encompasses the entire database. The Criterion range is made up of at least one field name and at least one row that contains specific criteria. For your purposes, the Output range should be a single row that contains the field names of the columns you want extracted from the Input range.

In your example, add field names to the tops of columns C and D, and identify range B1..D10 as the Input range. Enter the new field names in cells G1 and H1, and specify F1..H1 as the Output range. Then assign range A1..A4 as the Criterion range.

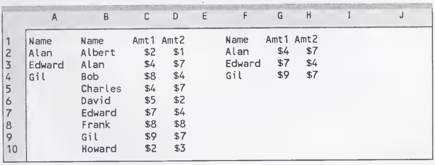
With these changes complete, select /Data Query Extract. Your worksheet should appear as shown in figure 2.



```
      A        B           C     D     E    F        G       H

1     Name     Name                         Name
2     Alan     Albert     $2    $1          Alan
3     Edward   Alan       $4    $7          Edward
4     Gil      Bob        $8    $4          Gil
5              Charles    $4    $7
6              David      $5    $2
7              Edward     $7    $4
8              Frank      $8    $8
9              Gil        $9    $7
10             Howard     $2    $3
```

FIGURE 1



```
      A        B          C     D     E    F        G     H     I     J

1     Name     Name       Amt1  Amt2       Name     Amt1  Amt2
2     Alan     Albert     $2    $1         Alan     $4    $7
3     Edward   Alan       $4    $7         Edward   $7    $4
4     Gil      Bob        $8    $4         Gil      $9    $7
5              Charles    $4    $7
6              David      $5    $2
7              Edward     $7    $4
8              Frank      $8    $8
9              Gil        $9    $7
10             Howard     $2    $3
```

FIGURE 2

DOCUMENTATION ERROR

Q. I've been trying to duplicate the figure shown on page 157 of the *1-2-3* Release 2 manual. I believe the formula shown in cell H3 is incorrect. Please print the correct formula.

Scott James
Natick, Mass

A. You're right, the formula in cell H3 should read:

+$D$19*C3+$E$19*D3+$E$13

Also, the value in cell E15 of that illustration should be 0.814661.

SYMPHONY

SPELLING CHECKER

Q. I have two questions about Spelling Checker for *Symphony* Release 2.0. Why does the message *Select Verify from DOC menu* appear every time Spelling Checker is automatically loaded? I must press the Escape key to clear the message before I can use *Symphony*.

Also, why does Spelling Checker ruin the format of a document? It closes up spaces in the document, especially spaces between columns. It's frustrating to have to reformat the document each time I run Spelling Checker.

Jo Ann Mays
Washington Dental Service
Seattle, Wash

A. You receive the *Select Verify from DOC menu* message if you configure Spelling Checker to attach automatically by entering Yes for the Auto-Invoke setting. You do not need to set Auto-Invoke to Yes to run this application. To use Spelling Checker after it's attached in a DOC window, press MENU and select Verify.

To eliminate the extraneous message

from your screen, press SERVICES and select Configuration Other Application Set, choose the number assigned to Spelling Checker, specify SPELLER.APP, and select No Quit Update Quit.

When you run Spelling Checker on a document that has both SHEET and DOC entries, *Symphony* may justify any information entered in the leftmost column of the window. Although we were not able to consistently re-create the second problem you describe, we found that when column A contained data entered in the DOC window and columns B through D contained data entered in the SHEET window, sometimes the format of the document changed after we ran Spelling Checker.

There are three ways to prevent justification of the data in a DOC window. Before you run Spelling Checker, select MENU Format Settings Auto-Justify No. Or you can use hard spaces and indent characters to maintain spacings after a document justifies. You can also use MENU Format Settings Justification None Quit.

SPECIALIZED DATABASE REPORT IN SYMPHONY

Q. After generating an entry form and entering hundreds of database records, I need to create some reports. When I print using the Report ranges *Symphony* created, the database field names appear on the first line of the report and the records follow one to each line. Is it possible to make the report look like the one below?

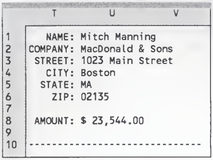
NAME: Mitch Manning
COMPANY: MacDonald & Sons
STREET: 1023 Main Street
CITY: Boston
STATE: MA
ZIP: 02135
AMOUNT: 23,544.00
- - - - - - - - - - - - - - - - - - - -

Brian Wlcek
Windham, N.H.

A. We've created a report in *Symphony* that looks like your example (see next column).

In a blank area of the worksheet, list the field names you want to use in the report. We've entered them in column T. Next, right-align these entries by selecting MENU Range Label-Alignment Right and specifying the range that contains the field names (range T1..T8, in our example).

Enter the formula *+NAME* in cell U1, enter *+COMPANY* in cell U2, and so on, until you've entered a formula for each field to be included in the report. As you enter these formulas, your first database record should appear. For example, the name from the first database record should appear when you enter *+NAME*. If this is not the case, position the cell pointer on the first field name above the first record in the database, select MENU Range Name Labels Down, and indicate the row of field names. This assigns the field names as range names to the cells below. Reenter the formulas in column U.



```
          T           U           V
1        NAME: Mitch Manning
2     COMPANY: MacDonald & Sons
3      STREET: 1023 Main Street
4        CITY: Boston
5       STATE: MA
6         ZIP: 02135
7
8      AMOUNT: $ 23,544.00
9
10  ----------------------------
```

Make column U wide enough to accommodate the longest field entry. With the cell pointer in column U, press MENU, select Width Set, and enter the width. Format the cell containing the AMOUNT field by selecting MENU Format Currency 2 and specifying cell U8. In cell T10 enter a backslash and a hyphen (\-), then copy cell T10 to range U10..V10.

Next, cancel the original database Report ranges and specify the new Main Report range: Select MENU Query Settings Cancel Report, then select Report Main and specify range T1..V12. To separate the printed records, we've included two blank rows in the Main Report range.

To print the new report, select SERVICES Print Settings Source Database, specify the correct database name, and select Quit Align Go Quit.

1-2-3/SYMPHONY

CHANGING THE CURRENCY FORMAT WITH LICS

Q. Can I change the currency format of a cell to a foreign monetary unit using the Lotus International Character Set? Also, how can I find a list of the LICS characters?

John J La Tessa

A. You can change the currency symbol displayed by *1-2-3* Release 2/2.01 and *Symphony*. For example, to change the default currency symbol from a dollar sign ($) to a British pound sign (£), select /Worksheet Global Default Other International Currency (in *Symphony*, SERVICES Configuration Other International Currency). Press Backspace to clear the existing character, then press COMPOSE (Alt-F1), enter *L=*, and select either Prefix or Suffix. Select Quit Update to change the default currency symbol for all future work sessions, or select Quit Quit to use the new currency symbol for this session only.

You can find a complete list of the Lotus International Character Set in the *1-2-3* and *Symphony* manuals.

CONVENTIONAL MEMORY IN BLANK WORKSHEET

Q. While working on one of my larger *1-2-3* Release 2.01 spreadsheets, I selected /Worksheet Status (in *Symphony*, SERVICES Settings) to check available memory and saw the following information:

Conventional Memory: 112287 of 361264 Bytes (31%)
Expanded Memory: 387292 of 900680 Bytes (43%)

I erased all cells that contained data, returned column widths and cell formats to the original default settings, and deleted all range names to determine the impact on conventional memory. Another status check revealed:

Conventional Memory: 112287 of 361264 Bytes (31%)
Expanded Memory: 900600 of 900680 Bytes (99%)

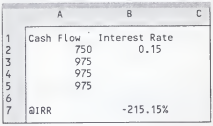
Why doesn't conventional memory change if you have a virtually blank, unformatted worksheet? Also, since you can't add conventional memory the way you can expanded memory, are there any ways to better manage conventional memory?

Stuart C Melvin
Porcelain Metals Corp.
Louisville, Ky

A. To regain conventional memory after deleting data and range names and resetting column widths and cell formats, you must save the worksheet and then retrieve it. Another status check should show 99% of conventional memory available. For tips on managing memory, see the article "Don't Squander Memory" in the November issue.

ERR WITH @IRR

Q. I need to calculate an internal rate of return using *Symphony* Release 2.0. The cash flow values in my worksheet are all positive, but the result of the function @IRR(B2,A2..A5) in cell B7 is either ERR or a negative IRR. What is the problem?



	A	B	C
1	Cash Flow	Interest Rate	
2	750	0.15	
3	975		
4	975		
5	975		
6			
7	@IRR	-215.15%	

Mark D Blair
Troy, Mont

A. @IRR solves for a rate of return on a series of cash flows. There must be at least one negative value in the range of cash flows to represent money invested or spent. If the range is all positive (or negative), the internal rate of return has no meaning because the @IRR function assumes that money has been invested and that there will be a return on that money over a period of time.

The cash flow entries in your example are all positive. Examine your data again to determine the amount of money invested in this project. Include that initial investment as the first entry in the range you specify to the function.

If the result of the @IRR formula is still ERR, try using a higher or lower guess number.

PAGE-BREAK SYMBOL DOESN'T ADVANCE PAGE

Q. I use *1-2-3* Release 2 and an Epson LQ-1000 printer. For some reason, the printer is printing the page-break symbol (::) instead of performing the page break. What can I do?

Julie Davis
Chapel Hill, N C

A. When you use the page-break symbol to force a page break, you must enter it correctly in the appropriate place within the Print range.

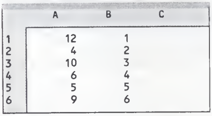
In *1-2-3* Release 2/2.01 place a page-break symbol in the worksheet by selecting /Worksheet Page. In *Symphony* insert a page break by selecting MENU Page in a DOC window. If you're entering the symbol manually, type a split vertical bar followed by two colons (¦::). The page-break symbol must fall in an otherwise blank row and in the leftmost column of the Print range. However you enter the page-break symbol, it has no effect if it isn't within the Print range.

Q&A REVISITED

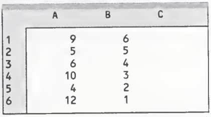
SIMPLER WAY TO INVERT A COLUMN OF NUMBERS

I have come up with a simpler solution to Deborah Shaw's question [September]. Use the Data Fill command (Range Fill command in *Symphony*), and then sort in descending order.

With the cell pointer in cell B1, select /Data Fill (in *Symphony*, MENU Range Fill) and specify B1..B6 as the Fill range. Specify a start number of 1, and press Return twice to accept the default step and stop numbers. Next, select /Data Sort Data-Range and indicate range A1..B6. Select Primary-Key, specify cell B1, enter *D* for descending order, and then choose Go. (In *Symphony* you must first create field names for the columns. With the cell pointer in cell A1, press MENU, select Insert Rows, and press Return. Enter the labels *First* in cell A1 and *Second* in cell B1. Next press MENU, select Query Settings Basic Database, and specify range A1..B7. Then select Quit Sort-Keys 1st-Key, specify B1, enter *D*, and choose Quit Record-Sort All Quit.) The column of numbers will be inverted. You can simply erase the values in column B. (In *Symphony* use the MENU Delete Rows command to delete row 1.) The following examples show the worksheet before and after the inversion.



	A	B	C
1	12	1	
2	4	2	
3	10	3	
4	6	4	
5	5	5	
6	9	6	



	A	B	C
1	9	6	
2	5	5	
3	6	4	
4	10	3	
5	4	2	
6	12	1	

Ms. Sam Stainbrook
U S. West Communications
Seattle, Wash

FORMULA TO RETURN .00% INSTEAD OF ERR

Your response to Wanda Kitchka's question about getting her formula to return .00% intead of ERR [September] can later cause a problem if referenced by another function. I have a solution that will not create additional ERRs in other formulas and will work in all releases of *1-2-3* and *Symphony*. Use the following formula and format the cell for percent with two decimal places:

@IF(D25=0,0,E25/D25)

If the divisor, cell D25, equals 0, the formula returns 0.00%. This result has one extra zero, but I believe it's a better solution than the one you presented.

Tom Miller
MicroProse Word Processing & Computing
Phoenix, Ariz

HARD DISK LOSES FILES

We had a problem similar to that of Lori Emmans [August]. Our newly installed hard disk started to lose files. I used *The Norton Utilities* to determine the problem and discovered that the file allocation table was damaged.

After several unsuccessful visits to a hardware technician, I found the solution through a local computer group. The problem was heat buildup and low power supply. The remedy was simple. We increased the power to 150 watts and made sure that the new power unit provided a good flow of air.

James C Bennett
Trumbull, Conn

DISK FULL ERROR MESSAGE WITH SPACE AVAILABLE

I'd like to add to your response to W. A. Followell regarding the *Disk full* error message [August]. Another cause of this problem may be saving to a disk that is formatted single-sided. Use the DOS CHKDSK command to determine the amount of storage space on the disk. A disk formatted single-sided will have 179,712 bytes total disk space. A disk formatted double-sided will have 362,496 bytes total disk space.

Joe DeOrdio
North Adams State College
North Adams, Mass.

{GETNUMBER} CONFUSION

Q. In your response to Kevin Besecker [September], there is a simple solution you didn't mention. Use the /XN command instead of the {GETNUMBER} command. The /XN command requires a numeric entry. If you try to enter a label in response to the command's prompt, an error occurs. Pressing the Escape key clears the error and causes the /XN command to restart. There is no way to enter a label accidentally in response to a /XN command.

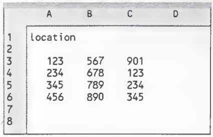
Jeffrey Cleary
Sears Roebuck & Co
Chicago, Ill

A. The /XN command works with all releases of *1-2-3*.

CONTEST

OCTOBER CONTEST RESULTS

In the October issue we asked users of *1-2-3* Release 2/2.01 and *Symphony* to create a mechanism by which the spreadsheet can determine whether the cell pointer resides within a specific named range. For example, if the cell pointer in the following worksheet resides within the range named *contest* (range A3..C6), your solution should cause 1 to appear in the cell named *location* (cell B1). If the cell pointer resides outside of *contest*, your solution should cause 0 to appear in *location*:



```
     A        B        C        D
1  location
2
3    123      567      901
4    234      678      123
5    345      789      234
6    456      890      345
7
8
```

The formula, @IF(@@(@CELLPOINTER(“address”))<>“ ”,@TRUE,@FALSE), which some of you used, works best in *1-2-3* Release 2.01. However, the formula requires that every cell in *contest* contain a label or a nonzero entry and that all other cells in the spreadsheet are blank. This solution isn't valid in *1-2-3* Release 2 or in *Symphony* because the formula returns ERR when the cell pointer is in a blank or numeric cell.

Other readers submitted the formula @IF(@CELLPOINTER(“protect”),0,1). To make this formula work, you must protect the worksheet by selecting /Worksheet Global Protection Enable (in *Symphony*, SERVICES Settings Global-Protection Yes Quit). Then select /Range Unprotect (in *Symphony*, MENU Range Protect Allow-Changes) and specify range A3..C6. This method isn't foolproof because *contest* must contain the only unprotected cells in the spreadsheet.

There are two versions of the winning formula. The first version is:

```
@ISERR(@INDEX(contest,
  @CELLPOINTER(“col”)−
  @CELL(“col”,contest),
  @CELLPOINTER(“row”)−
  @CELL(“row”,contest)))=0
```

The second version of the winning formula is:

```
1−@ISERR(@INDEX(contest,
  @CELLPOINTER(“col”)−
  @CELL(“col”,contest),
  @CELLPOINTER(“row”)−
  @CELL(“row”,contest)))
```

These formulas contain identical complex @ISERR functions. To understand how the formulas work, let's look at the components of the matching portions.

The key to the formulas is their use of the @INDEX function, which has the syntax @INDEX(*range,col,row*). The function means “return the value that is *col* columns to the right, and *row* rows down from the upper-left cell of *range*.” In our sample worksheet, the formula @INDEX(contest,1,1) would return 678—the value one column to the right and one row down from the upper-left cell in *contest*. If the *col* or *row* arguments define a location beyond the boundaries of *range*, the @INDEX function returns ERR.

In the winning formula, the *col* argument of the @INDEX function is the expression @CELLPOINTER(“col”) − @CELL(“col”,contest). This subtracts the number of the leftmost column of *contest* from the column number of the current cell. When the cell pointer is within *contest*, the expression returns a valid *col* argument for the @INDEX function; otherwise, the expression returns an invalid *col* argument.

Similarly, the *row* argument of the @INDEX function is the expression @CELLPOINTER(“row”) − @CELL (“row”,contest). This returns a valid *row* argument for the @INDEX function when the cell pointer is within *contest* and an invalid argument otherwise.

The winning formula encloses the @INDEX expression within an @ISERR function. The @INDEX expression returns ERR and the @ISERR function returns 1 when either the *col* or the *row* argument is invalid. When both *col* and *row* are valid, the @INDEX expression returns a value from within *contest* and the @ISERR function returns 0. The only time the formulas won't work is when the *col* and *row* arguments identify a cell within *contest* that contains the value ERR.

In any case, the result of the @ISERR expression is the opposite of the result we requested. Therefore, one of the winning formulas subtracts the @ISERR expression's result from 1, and the other equates the @ISERR expression's result to 0. Each strategy returns the required value.

The following readers submitted winning entries: Christopher W. Brooks, Washington Crossing, Pa.; Robert F. Bullock, Summit, N.J.; Robert S. England, Meriden, Conn.; Sean Henry, Richardson, Tex.; Daniel Redfield, Hartford, Conn.; Peter Zwick, Bainbridge Island, Wash. ■

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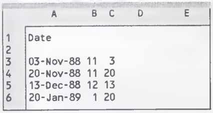
READER TIPS ON USING LOTUS PRODUCTS

1-2-3/SYMPHONY

ENTERING DATES

Using the @DATE function to enter dates in *1-2-3* or *Symphony* is cumbersome. The following technique circumvents having to enter the @DATE function for each date entry.



```
          A          B  C     D         E
1   Date
2
3   03-Nov-88 11  3
4   20-Nov-88 11 20
5   13-Dec-88 12 13
6   20-Jan-89  1 20
```

To try this technique, start in a blank worksheet and enter the formula @DATE (88,B3,C3) in cell A3. The formula evaluates to ERR before you enter month and day values in cells B3 and C3, but ignore the ERR for now and assign the Date 1 format to cell A3. Make sure that column A is wide enough to display the date. Copy the formula down column A as far as necessary for entering dates. Enter the month and day numbers in columns B and C, respectively. When you've entered all the dates, select /Range Value (in *Symphony*, MENU Range Values) and convert the @DATE formulas in column A to values. Finish by deleting columns B and C.

Saul Pfeffer
Gold Castle Holdings
Montreal, Quebec

CENTERING HEADINGS

Centering a heading over several columns can be a tedious trial-and-error effort, especially when you change the heading's length several times. I developed a nonmacro technique that updates the heading cell and recenters its entry over the width of the range. This solution uses a combination of string functions and concatenation.

To create a centered heading like the one shown in row 2 of the worksheet below, enter the formula @CELL ("width",!B66) in cell B67, and copy the formula to range C67..D67. These formulas evaluate the widths of columns B, C, and D. Assign the name *width* to range B67..D67. Enter the labels shown in range A67..A69. Press slash (in *Symphony*, MENU), select Range Name Labels Right and specify range A68..A69. In cell B69 enter the date portion of the heading you wish to center, and in cell B68 enter the following formula:

@REPEAT(" ",(@SUM(width)–
@LENGTH("As of ")–
@LENGTH(date))/2)

This formula returns a series of space characters, since it subtracts the number of characters in the labels from the total width of the columns and stores half of the number of the remaining blank spaces. Cell B68 appears blank in the worksheet. In cell B2 enter the following formula:

+spaces&"As of "&date

This formula concatenates the spaces to the heading so that the heading appears centered over the columns.

Now you need to edit only the label in cell B69 to reflect the month you're reporting on. The formulas automatically center the heading between columns B, C, and D of the worksheet.

Gale L. Raphael, CPA
Raphael and Raphael
Boston, Mass.

Your formula returns ERR when date *grows to within 5 characters of* width. *The following approach lets you create* date *up to* width *characters. Enter the entire heading in cell B69. Shorten the formula in cell B68 to:*

@REPEAT(" ",(@SUM(width)–
@LENGTH(DATE))/2)

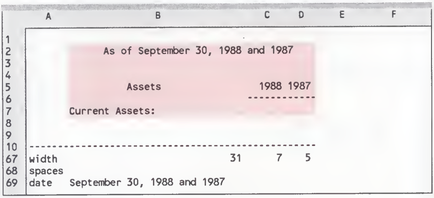
Shorten the formula in cell B2 to:

+spaces&date

Both sets of formulas are updated only when they are recalculated. If you change the width of column B, C, or D, press the CALC key to recenter the heading. This solution will not work in 1-2-3 *Release 1A.*

FINDING THE COLUMN LABEL

In *1-2-3* or *Symphony*, I often need to find the column letter, but the @CELL("col") and @CELLPOINTER



```
        A                  B                    C    D      E        F
1
2            As of September 30, 1988 and 1987
3
4
5                Assets                     1988 1987
6                                           ---------
7            Current Assets:
8
9
10  --------------------------------------------------
67  width                          31       7    5
68  spaces
69  date     September 30, 1988 and 1987
```

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82A

("col") functions can return only a number designating a column. The following formula converts a column number to a label. For example, enter *27* in cell A1 to represent a column number. Then enter in cell B1 the following formula, which evaluates to AA. If you enter *2* in cell A1, the formula returns B.

@IF(A1<27,@CHAR(@MOD(A1−1,26)+65),@CHAR(@INT(A1/26.01)+64)&@CHAR(@MOD(A1−1,26)+65))

The formula uses the @CHAR function to convert Lotus International Character Set codes 65 through 90 to the appropriate characters, A through Z. The @IF statement separates the first 26 single-character column letters from the double-character column letters, AA through IV. The mathematical functions @MOD and @INT provide an easy and elegant way to convert the column numbers to the appropriate LICS codes. The formula also allows you to go beyond the 256-column limit. If you enter *257* in cell A1, cell B1 returns IW even though there isn't a column IW in *1-2-3* or *Symphony*.

Simon Chen
Toys"R"Us
Rochelle Park, NJ

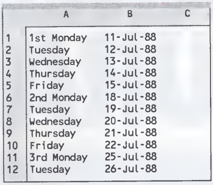
You cannot use this technique in 1-2-3 *Release 1A.*

FILL A RANGE WITH DATES, OMIT WEEKENDS

I sometimes need to enter daily invoicing data in a *1-2-3* worksheet. Since we work Monday through Friday, I created a formula to make it easy to fill a range with consecutive dates, omitting Saturday and Sunday. To see how it works, use the @DATE function to enter the starting date in cell B1, the first cell of the range to be filled. In cell B2 enter:

@IF(@MOD(B1+1,7)=0,B1+3,B1+1)

Copy this formula down far enough in column B to accommodate as many days as you need in your model. The formula uses an @IF function to determine whether the preceding date plus one day is a Saturday. If so, the @IF formula adds three days to the preceding date, returning next Monday's date; otherwise, the formula adds only one day to the previous date.



	A	B	C
1	1st Monday	11-Jul-88	
2	Tuesday	12-Jul-88	
3	Wednesday	13-Jul-88	
4	Thursday	14-Jul-88	
5	Friday	15-Jul-88	
6	2nd Monday	18-Jul-88	
7	Tuesday	19-Jul-88	
8	Wednesday	20-Jul-88	
9	Thursday	21-Jul-88	
10	Friday	22-Jul-88	
11	3rd Monday	25-Jul-88	
12	Tuesday	26-Jul-88	

David A. Martin
Knoxville, Tenn

The following formula is shorter and performs the same calculation:

+B1+1+(@MOD(B1,7)=6)∗2

Neither formula works properly if you enter a Saturday as the starting date (in cell B1).

USING CALC IN THE CONTROL PANEL

The CALC key is excellent at saving keystrokes. Suppose you're adding a list of numbers and need to view subtotals before you enter the final total in a single cell. You can do this in a spreadsheet by typing the numbers, such as 56+89+97, pressing the CALC key, making a note of the subtotal, and then continuing to enter numbers. This method of viewing subtotals works even if your formulas refer to values in other cells. However, be aware that when you use the CALC key to evaluate a formula, you lose the formula itself and are left with only the formula's current value.

Joel Hershfield
Department of Attorney-General
Winnipeg, Manitoba

When you use cell addresses in your formulas, you must type the cell addresses rather than point to the desired cells. Pressing CALC while the worksheet is in Point mode does not evaluate a formula.

USE @REPEAT TO COPY FORMULAS ACCURATELY

The @ISERR function in *1-2-3* [and *Symphony*] works great for trapping errors, but I have difficulty re-creating long formulas without typing mistakes. The following technique eliminates the need to retype formulas. Let's assume that the original formula is:

@VLOOKUP($L3,$B$174..$D$300,2)

First, place the cell pointer on the cell that contains this formula and press the EDIT key. Then press the HOME key, and add the @REPEAT function to the formula:

@REPEAT("@VLOOKUP($L3,$B$174..$D$300,2)",2)

When you enter the new formula, the following appears in the cell:

@VLOOKUP($L3,$B$174..$D$300,2)@VLOOKUP($L3,$B$174..$D$300,2)

Next, use the Range Value command (in *Symphony*, Range Values) to convert the formula into its current value. Once you create two accurate copies of the formula in a single cell, you can use the entry to build an @IF formula as follows:

@IF(@ISERR(@VLOOKUP($L3,$B$174..$D$300,2)),0,@VLOOKUP($L3,$B$174..$D$300,2))

Although this method involves an extra step, it saves time because it increases the accuracy of your results.

John Warrener
Macon, Ga

The @REPEAT function isn't available in 1-2-3 *Release 1A.*

USE ARROW KEYS WHEN SETTING COLUMN WIDTHS

When you select /Worksheet Column Set-Width, *1-2-3* prompts you for the number of characters to display in the current column. If you know the exact number, you can enter it. If you don't, there is an easy way to get the exact column-width setting. After you select /Worksheet Column Set-Width, press the RightArrow or LeftArrow key to increase or decrease the width of the column one space at a time. When the column appears as you want it, press Return to accept that width.

Don DeHaven
Timonium, Md

This technique works in all releases of

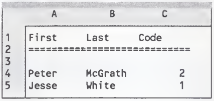
1-2-3 and Symphony. *In* Symphony, *select MENU Width Set, and press the RightArrow or LeftArrow key to increase or decrease the column width.*

1-2-3

TRICKS FOR A MORE READABLE DATABASE

The first row of a *1-2-3* database contains the field names, and the second row contains the first database record. I'm not thrilled by this arrangement. In *1-2-3* Release 1A, there's nothing you can do about it, but in *1-2-3* Release 2/2.01, the following technique makes the database more readable and generates reports that are more attractive.

Enter the field names in row 1, and enter a separator row by pressing backslash and an equal sign (\=) in cell A2 and copying that cell across row 2. Copy the field names from row 1 to row 3, then use the Range Format Hidden command to hide the second set of field names. When you assign the Data Query command's Input range, include only the hidden field names in row 3 and the data records as the Input range (in our example, range A3..C5).



```
        A          B          C
1  First      Last       Code
2  ============================
3
4  Peter      McGrath        2
5  Jesse      White          1
```

Daniel A Morgan
Morgan, Steenman & Tuininga
Mercer Island, Wash.

REVISITED

SUMMING EVERY NTH CELL IN A COLUMN

In the July 1988 issue, Mark Naigles shared his macro solution for summing every nth row in a column. I'd like to share my nonmacro technique for performing the same task. It uses *1-2-3*'s @DSUM function and eliminates the need to run a macro whenever you alter spreadsheet entries.

Using Naigles's example, insert a row at row 1, and enter the column headings *Year* in cell A1 and *Data* in cell B1. Select /Range Name Create and define *database* as range A1..B17. Set up a summary table for the subtotals as shown in range C1..D6, but leave cells D2, D4, and D6 blank. Be sure to enter the label *Year* and the actual years just as they appear in the database. Now enter the formula @DSUM($database,1, C1..C2) in cell D2 and copy that cell to cells D4 and D6. The @DSUM formula returns the total for all states for each year specified. This approach will work even if the data for each year doesn't fall in every nth cell. Thus, if you inadvertently insert a blank line between two states, the @DSUM formulas still give the correct results, whereas Naigles's macro would fail. Make sure that if you insert a row, you don't insert it between the field names and the @DSUM formula, which is used as the criterion in the summary table.

The following example assumes that there is a unique identifier, such as 1985 or 1986, in each nth row. However, even if there are no identifiers, you

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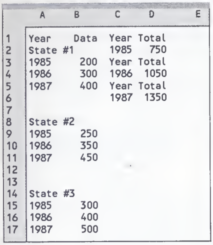
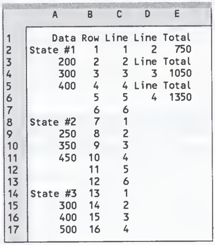


```
     A      B      C    D      E
 1  Year   Data   Year Total
 2  State #1      1985   750
 3  1985    200   Year Total
 4  1986    300   1986  1050
 5  1987    400   Year Total
 6                1987  1350
 7
 8  State #2
 9  1985    250
10  1986    350
11  1987    450
12
13
14  State #3
15  1985    300
16  1986    400
17  1987    500
```

can use the @DSUM function to update subtotals automatically for every nth row, without using a macro.

The second example uses the same data, but there is no *Year* column. To calculate subtotals, add the auxiliary columns, labeled *Row* and *Line*. Use the Data Fill command (Range Fill in *Symphony*) to fill the *Row* column with sequential row numbers for the database. Start with *1* for the first row of data, and increase by one for each succeeding row. Enter the following formula in cell C2, and copy it to cells C3..C17. This formula numbers the lines 1 through 6 within each six-row block of the range.

@IF(@MOD(B2,6)=0,6,@MOD(B2,6))



```
       A        B    C    D     E
 1         Data Row Line Line Total
 2  State #1    1    1    2    750
 3        200   2    2 Line Total
 4        300   3    3    3   1050
 5        400   4    4 Line Total
 6              5    5    4   1350
 7              6    6
 8  State #2    7    1
 9        250   8    2
10        350   9    3
11        450  10    4
12             11    5
13             12    6
14  State #3   13    1
15        300  14    2
16        400  15    3
17        500  16    4
```

Assign the name *database* to range A1..C17. Set up a table for the subtotals, and into cell E2 enter the formula @DSUM($database,0,D1..D2). Copy cell E2 to cells E4 and E6.

Alan P. Dubin
Tustin, Calif

This @DSUM solution works fine when the number of Criterion ranges is small but becomes cumbersome when the number of unique identifiers, and hence, Criterion ranges, becomes large. Thus, your method is good for a model with only a few criteria. Also, we usually suggest to set up a database in which the first row contains the field names and the second row contains the first database record. Although your way isn't the correct way to set up a database, it works for this application. ■

This material is prepared by Subhadra Mattai and the Technical Editors, with the help of the Lotus Product Support staff.

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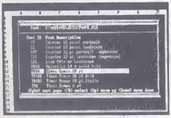

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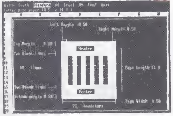

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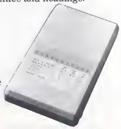

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THE 1988 LOTUS

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JANUARY THROUGH DECEMBER, 1988

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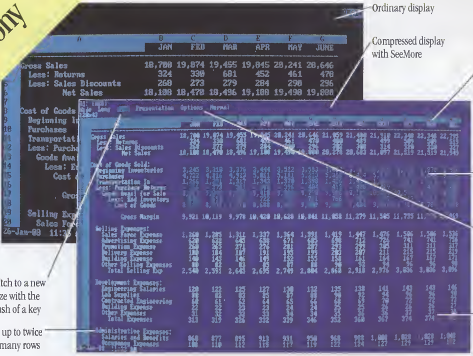
For 1-2-3 and Symphony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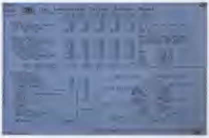

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CIRCLE 115 ON READER SERVICE CARD

COLOR FOR REPORTS AND OVERHEAD TRANSPARENCIES

The HP PaintJet and Xerox 4020 color ink-jet printers

BY WILLIAM G. SAUNDERS

While laser printers are leaders in producing high-quality black-and-white output, no leader has emerged for printing in color. Pen plotters are slow and fill solid areas unevenly. Color dot-matrix printers share that problem and are also noisy. Thermal-transfer printers, at a minimum cost of $4,500, are too expensive for most applications, and color laser printers, which start at $14,000, present the same obstacle.

Now two color ink-jet printers, Hewlett-Packard's PaintJet and Xerox's 4020, have solved many of those problems. Priced at $1,395 and $1,495, respectively, these printers fill solid areas well, offer a wide variety of colors, and are quiet. Neither requires you to change pens as you might with a plotter, and both can combine near-letter-quality text and color graphics on the same page. Although both printers are faster than previous ink-jet printers, they remain relatively slow.

As the proximity of their prices suggests, the HP PaintJet and the Xerox 4020 are head-on competitors. That doesn't mean they are basically the same machine. In fact, they differ in numerous ways, and you must make tradeoffs in choosing between them. You face such decisions as whether you want the best print quality or the easiest maintenance, and whether you want to print transparencies more conveniently or to print more rapidly on paper.

The HP PaintJet is significantly smaller and lighter, prints slightly faster on paper, and is slightly less expensive. Its disposable ink cartridges also contain its ink-spraying nozzles. If the nozzles ever clog, you can replace them yourself. The PaintJet's cartridges are also easier to load than are those of the 4020. However, the PaintJet's paper feed is poorly suited for transparencies, and the transparencies it produces aren't as attractive as those produced by the 4020.

The Xerox machine produces richer, brighter colors than does the PaintJet, regardless of the medium you choose. If you choose paper, you'll find Xerox's white paper is whiter than the PaintJet's and its black ink is blacker, producing a sharper black-and-white print. If you choose to print spreadsheets, the 4020's ability to print on 11-inch-wide paper will appeal.

Reference to printing spreadsheets on either machine might be misleading. Both Xerox and Hewlett-Packard say their color ink-jet printers can print everything from no-frills, black-and-white text to fancy color graphics. But if you need only black-and-white output, these printers can't compare with the speed of good dot-matrix printers or with the speed and resolution of laser printers.

There is another significant limitation to keep in mind: Color ink-jet printers have yet to solve the problem of adding color to reports that you need more than a few copies of. Few offices have color copiers, and the slow speed

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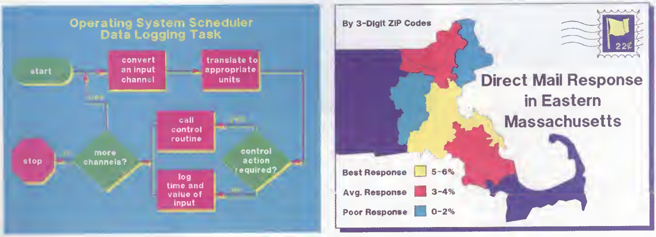
William G. Saunders, a consultant based in North Reading, Mass., is a frequent contributor to LOTUS *magazine.*



The Xerox 4020 printed the graphic on the left; the HP PaintJet printed the one on the right.

CIRCLE 116 ON READER SERVICE CARD →

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with which either printer creates full-color graphics makes it impractical to produce a large number of originals.

PRINT QUALITY

Both printers employ four ink colors—cyan, magenta, yellow, and black—to create seven colors. Cyan, magenta, yellow, red, green, blue, and black are produced with ink, while the white of the paper is considered an eighth color. Color printers can interleave the colors to create additional hues. Xerox claims that the 4020 can produce 4,096 colors; Hewlett-Packard claims 330 for the PaintJet, although Hewlett-Packard says that some software can work with the PaintJet to produce many more colors than that.

Don't be dazzled by those numbers. I judged the 4020's mixed colors unacceptable, based on samples I printed with *Lotus Graphwriter II* and *Lotus Freelance Plus*, because the dots used to produce them are so large that they prevent the colors from blending smoothly. The PaintJet's mixed colors were much smoother, but your ability to print mixed colors also depends on your software's printer driver. Many programs I tried limited me to far fewer colors than either printer supposedly can produce. Both *1-2-3* and *Symphony* can produce only eight colors with either printer.

Compatibility between a printer and a software program is a key issue, and many programs, such as *Lotus Manuscript*—which works with the HP PaintJet but not the 4020—don't work with one or the other printer. Even among programs that do work with these printers, you may have to take an extra step to achieve compatibility. For example, the Xerox printer uses an existing driver to print text and graphics with *1-2-3* and *Symphony*, while the PaintJet requires you to purchase a driver separately ($25, from Phoenix Technologies of Norwood, Mass).

The PaintJet's maximum resolution is rated about 12% higher than the 4020's resolution. Resolution is determined by multiplying the first number of a resolution rating by the second number. The PaintJet's 180 by 180 dots per inch (for a total of 32,400 dots) compares with the 4020's 240 by 120 dpi (for a total of 28,800 dots). However, those figures don't tell the whole story.

For one thing, resolution is another area where software compatibility is an issue. If you use *Lotus Freelance Plus* or *Lotus Graphwriter II* with the 4020, you'll get only 120 by 120 dpi, lowering that printer's resolution to less than half that of the PaintJet. Second, if you use software that takes full advantage of both printers and you print 10-pitch black type, the black that the Xerox produces will be darker and thicker, which will make the output easier to read. If you print on paper, the effect is even more pronounced because of the Xerox paper's whiter color. The difference in print density between the two machines is less apparent as the type size decreases.

You can choose among three type sizes with either printer. The 4020 offers 10-, 12-, and 17-pitch text, and PaintJet offers 10-, 12-, and 18-pitch text. The smaller sizes, designated by the greater numbers, are advantageous if you plan to print spreadsheets because they allow you to fit more of the spreadsheet onto a single page.

AS SIMILAR AS THESE TWO PRINTERS ARE, YOU MUST STILL MAKE TRADE-OFFS IN CHOOSING BETWEEN THEM.

It's also often desirable to print your spreadsheets sideways or on larger paper. The 4020 can use paper up to 11 inches wide, with 9 inches available to print on. The PaintJet is limited to paper 8½ inches wide, with 8 inches available for printing. The PaintJet's sole advantage in this category is that, for black-and-white printing only, it works with the printing utility *Sideways* ($69.95, from Funk Software, Cambridge, Mass.).

Ink-jet printers use small nozzles to spray drops of ink onto the page. Because no printing element strikes the page, they are very quiet. But spraying the ink drops takes time, and earlier ink-jet printers tended to be slow. While neither of these printers will set any speed records, they both have more jets than did earlier models, and each jet sprays ink at a faster rate.

Xerox uses 20 jets, 8 jets of black and 4 jets each of cyan, magenta, and yellow, while Hewlett-Packard uses 60 jets, 30 jets of black and 10 jets each of cyan, magenta, and yellow. The PaintJet's larger number of jets lets it print faster than the 4020, but just how much faster varies with the complexity and type of image it is printing. For example, printing a page of 10-pitch black spreadsheet text took 45 seconds on the PaintJet versus 120 seconds on the Xerox 4020. The difference narrowed when I printed a *1-2-3* bar chart with black text and two additional colors for the bars. That took 3 minutes on the Hewlett-Packard machine and 4¼ minutes on the Xerox. The greatest difference emerges when you print images that require a lot of color fill. A *Graphwriter II* bar chart with a solid-colored background took more than three times as long on the Xerox: 13½ minutes as opposed to 4¼ minutes on the PaintJet.

Paradoxically, the PaintJet is often slower than the Xerox machine when you print transparencies. The 4020 produces transparencies in a single pass of its print mechanism, whereas the PaintJet requires two passes to produce colors that are sufficiently saturated for use on an overhead projector. That means that the *1-2-3* bar chart that the PaintJet produced in 3 minutes on paper took 6 minutes to produce as a transparency. The 4020 produced the transparency in the same 4¼ minutes that it took to produce the paper print, and the transparency was better-looking.

Whichever machine you use, after you print the transparencies, you must allow them to dry for a couple of minutes so that the inks don't smear. In addition, Hewlett-Packard recommends that you place them in a special sleeve for about two hours, to enhance the transparencies' brilliance. One user reported that to prevent subsequent fading, it's a good idea to store them in the sleeve as well.

KEEPING THEM HEALTHY

Reliability was once a problem for ink-jet printers. The small openings in their nozzles would frequently clog, inks smeared on the page, and the job of refilling their ink reservoirs was a messy one. Both the Xerox and the Hewlett-Packard printers achieve breakthroughs in this area. The Xerox printer automatically cleans and caps its nozzles when it finishes printing. The Hewlett-Packard system combines the nozzles and the ink reservoir in the same disposable cartridge.

If the PaintJet's nozzles clog, there's a wiping pad to clean the nozzles with and a device for priming the cartridge. If these measures fail to get the nozzle working again, you can simply discard the cartridge and insert a new one. If the 4020's nozzles clog, you can invoke a purge cycle to clean them. But if that fails, you have no alternative but to send the machine to a service center.

How much this clogged-jet problem should concern you is hard to assess, but my experience may be a guide. At the outset of my test, after unpacking and setting up each printer, at least some jets on each printer didn't work. The recommended cleaning methods cleared up the problems on both printers. Afterward, neither printers' nozzles ever clogged, even after sitting unused for an extended period of time.

Reloading the HP PaintJet with ink is easy; you simply replace one of the disposable cartridges. Hewlett-Packard claims that the black cartridge ($27.95) can print 1,100 text pages and the color cartridge ($34.95) can print 180 graphics pages or 160 color transparencies before needing a replacement. Even though the PaintJet makes two passes on transparencies, on the second pass it re-inks dots only with primary colors—that is, those areas that didn't take two different colored dots on the first pass. That's why transparencies use up only a little more ink. Xerox claims about 60 pages per color or black-and-white cartridge ($10.95 for a box of two). So, including paper, it will cost you about 25 cents per paper page of color graphics on the PaintJet and about 15 cents on the 4020.

However, you could easily use up cartridges if your graphs contain large filled-in sections. The additional ink to produce a color graphic with large filled-in areas could raise the cost per page to as much as $1.50. If you use one color more than any other with the HP PaintJet, you are also susceptible to higher costs. For example, if your charts are always cyan, you will have to replace the entire colored-ink cartridge when the cyan runs out, even though you haven't used the other inks. The 4020 does not pose this problem; you can replace its color cartridges separately.

And what about running out of ink? The PaintJet does not have an out-of-ink indicator, and it will keep printing even if it runs out of one color of ink. That makes it possible to print an entire batch of graphics, only to discover that some of the necessary colors are missing. There's no chance of that happening with the 4020, which will cease printing if any ink reservoir runs dry. The 4020 also has four indicator lights to tell you which ink has run out.

However, when you have to refill an ink reservoir, you'll find the 4020 slightly harder to reload than the PaintJet. Each of the 4020's colored inks comes in a small vial that you must empty into one of the ink reservoirs. Although the ink vials and ink reservoirs are keyed to prevent you from loading the wrong ink into a reservoir, the PaintJet's replaceable cartridges are easier to use.

WHILE NEITHER OF THESE MACHINES WILL SET ANY SPEED RECORDS, THEY ARE FASTER THAN EARLIER INK-JET MODELS.

Both manufacturers recommend that you use their own coated paper and overhead transparencies, and there's reason to follow those recommendations. The coating on these papers produces better printed colors and quickly absorbs ink to prevent smearing. Also, their papers are less likely to clog the printers' nozzles because they don't produce as much lint as standard paper.

Complying with this recommendation means higher cost and lower flexibility. Coated paper costs more than the uncoated variety, and the need for it limits your ability to print onto your letterhead or any other plain paper. You can do so, but it's more likely that the printed colors will blur and the paper will rumple.

Both papers are coated on one side only, but only Hewlett-Packard clearly marks the proper side in the tractor-feed margin. The lack of such a mark on the Xerox paper may cause you to print on the wrong side. The 4020's paper is somewhat thinner and less rigid, and despite its coating, it buckled slightly when I printed a graphic that deposited a lot of ink on the paper.

Both manufacturers offer single sheets and Z-fold paper. Xerox also offers paper on a roll. Transparencies, however, are available only as single sheets. That means you can't batch print a series of overheads unless you're willing to tape the transparencies together. The HP PaintJet makes it hard to center the image on a transparency because you have to advance the transparency quite far before it reaches the printer's paper-feeding mechanism. That forces the printer to print off center and often past the edge of the transparency.

You can devise a remedy of sorts, but it's inconvenient. After making a test print and noting the distance of the improper offset, I taped the transparency to a sheet of paper at an offset equivalent to that distance. I then fed the paper-transparency combination into the printer's paper-feed mechanism, with the protruding edge of the paper in first, and the printer centered the printout.

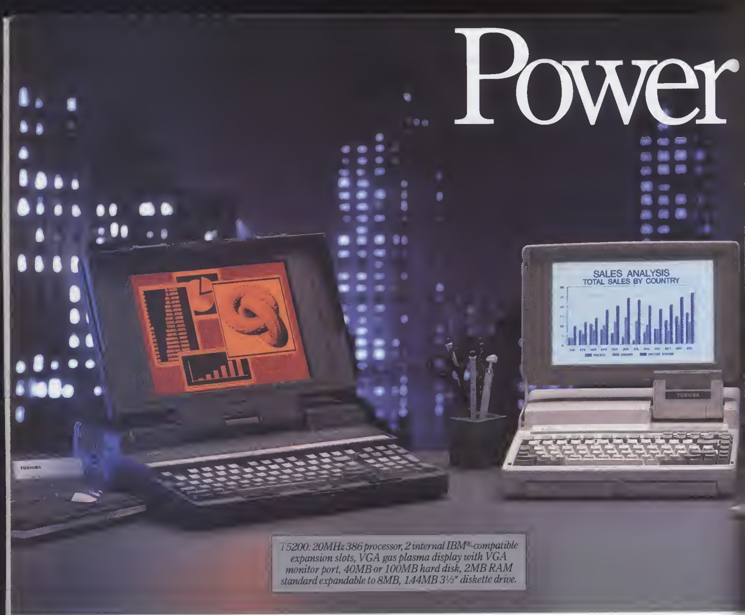
Both printers are easy to set up. The process is similar to that of setting up a dot-matrix printer, except you must load ink. The documentation is clear, but the Xerox manual lacks an index, making it more difficult to locate the information you need. In the standard model of either printer, you connect it to your computer's parallel port with a cable—Xerox supplies the cable, Hewlett-Packard does not. Both models are available in serial-port configurations. I recommend the parallel-port model because, in some cases, a printer connected to a parallel port prints faster than the same printer connected to a serial port. ■

IN BRIEF

HP PaintJet. Inquiries Manager, Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303; 800-367-4772, or contact a local Hewlett-Packard sales office. Parallel or serial interface model, $1,395; one-year warranty.

Xerox 4020 Color Ink-jet Printer. 4020 Product Manager, Xerox Corp., 901 Page Ave., Fremont, CA 94537; 415-498-7964. Parallel or serial interface model, $1,495; one-year warranty.

Power



T5200: 20MHz 386 processor, 2 internal IBM®-compatible expansion slots, VGA gas plasma display with VGA monitor port, 40MB or 100MB hard disk, 2MB RAM standard expandable to 8MB, 1.44MB 3½" diskette drive.

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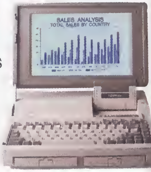

T1600: Battery-powered 286/12MHz, coprocessor socket, 20MB hard disk at 27msec, 1.44MB 3½" diskette drive, 1MB RAM expandable to 5MB, detachable backlit EGA compatible LCD, removable rechargeable battery pack.

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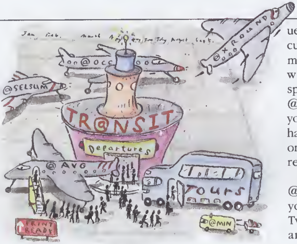
CIRCLE 117 ON READER SERVICE CARD

@LIBRARY VOLUME I

Work more efficiently by teaming these @functions with *1-2-3* and *Symphony*.

BY MARK SAKS

If you create financial worksheets, several of *@Library Volume I*'s 48 @functions can save you work and recalculation time. If you often convert spreadsheet tables into databases to avail yourself of *1-2-3*'s or *Symphony*'s database @functions for selective reporting, *@Library* offers two convenient alternatives. And if you automate your applications with macros, this package contains a number of @functions, each of which can do the work of several lines of macro code.



JESSIE HARTLAND

@Library's mixture of @functions complements rather than competes with the product called *@functions#1* (Intex Solutions, Needham, Mass.), which was reviewed in our July 1988 issue. *@Library* is targeted more for financial, statistical, and mathematical applications than is *@functions#1*, which consists primarily of functions for string operations, calendar applications, and logical tests.

If you need to conserve memory, *@Library* may frustrate you. Its 48 @functions are grouped into four sublibraries so that you can attach to *1-2-3* or *Symphony* only those sublibraries containing the @functions you need. This design is intended to conserve memory. However, the way the @functions are grouped may be inappropriate for your application. For example, if you do lots of financial modeling, you may want to attach as many as three of the four sublibraries. And although you will need only a handful of the @functions in each, you must squander valuable RAM on many @functions you're not likely to use. *@Library* should have more sublibraries that contain fewer, but more closely related, @functions.

FINANCIAL APPLICATIONS

If you aren't pushing the limits of your RAM and you have worksheets that calculate the time value of money, *@Library*'s financial @functions may be able to do the same work with fewer formulas than you now use. For instance, using only two @functions you can compute the principal and interest of a single payment on an ordinary-annuity loan. That's much easier than generating an entire amortization table.

Other financial @functions help you avoid entering complex formulas. For example, suppose you're computing the future value of an investment, where interest is compounded at a different rate each period. Calculating that future value without *@Library* would require you to enter a formula comprising separate calculations for each period. You can do the same work with one of *@Library*'s @functions by entering only two arguments: the amount of the principal and the range containing the interest rates.

If you now calculate various time values of money with a financial calculator, *@Library* lets you do much of the same work entirely within a *1-2-3* or *Symphony* spreadsheet. If you substitute @functions for a calculator, when your data changes, you won't have to reenter your equations on the calculator and reenter the results in your worksheet.

@Library includes other @functions that save time when you use financial worksheets. Two worth noting compute sums and averages of mathematical products. These functions easily compute weighted sums and weighted averages of values, even if those values are subject to different weights. Suppose you are preparing revenue projections for a machine that is sold at different discount rates. One @function computes the average revenue per machine; the other calculates the total revenue brought in by all machines.

The @XROUND function enhances *1-2-3*'s and *Symphony*'s @ROUND functions by letting you round numbers to the nearest multiple of any number rather than to the nearest decimal place. This is useful in cases where you need extra precision, such as when you need to round to the nearest nickel. Even if you round only to multiples of 10, you may find @XROUND more intuitive than @ROUND because @XROUND lets you specify the number you want to round to, such as 100 or 0.1, rather than the power of 10.

QUICK QUERIES

@Library provides two work-saving @functions that enable you to sum selected data or to count the occurrences of selected data that reside in a range of your worksheet. For a particular column in a range, @SELSUM will sum

Mark Saks is an associate professor of mathematics at the Community College of Pennsylvania.

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We could go on about the many features of Symphony 2.0—how its macros let you automate complex or repetitive tasks and create customized applications. How the word processor now has a spelling checker and text outliner. And how database and communications have been improved.

The bottom line is that Symphony is one high performance package that's made to be opened up.

Lotus Symphony 2.0

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only those values that are contained in records that match your criteria. For example, if you want to find out the total amount by which your accounts receivable is in arrears, specify @SELSUM to sum the current balances of only those records in which the status column reads *past due*. To get the same result without @SELSUM, you would have to create a Criterion range, specify your criteria, and enter an @DSUM formula to calculate the sum.

Another @function, @OCCUR, counts the occurrences of a particular number or label in a specified range. The advantage of @OCCUR versus *1-2-3*'s or *Symphony*'s @DCOUNT emerges when you want to count occurrences in a table that you haven't set up as a *1-2-3* or *Symphony* database. @DCOUNT requires you to add field names to the top of the table and to create a Criterion range. @OCCUR lets you skip those steps. @OCCUR also lets you count occurrences in more than one column. @DCOUNT does not.

@SELSUM and @OCCUR share one drawback. When specifying criteria for summing or counting, you can use only a single value or label as a criterion. You cannot use a range of numbers, a logical statement, or a wild card, as you can in a *1-2-3* or *Symphony* Criterion range. This means, for instance, that if you want to count the occurrences of *Mrs.*, *Miss*, and *Ms.* in a mailing list, you have to use @OCCUR three times and total the results with another formula.

NEW STATISTICAL @FUNCTIONS

Several of *1-2-3*'s and *Symphony*'s native statistical @functions, such as @AVG and @MIN, return no answer or an invalid answer when the range or ranges upon which they operate include cells containing NA, ERR, or labels. *@Library* provides corresponding @functions that ignore cells containing these entries. However, unlike the native statistical @functions, which can reference more than one range, *@Library* lets you specify only a single range for calculation. That limitation is inconvenient and may force you to place in one range data that you previously stored in several ranges. Consider, too, that Lotus's @functions protect you from obtaining invalid results. If you use *@Library*'s statistical @functions, you lose that protection.

@Library's @MEDIAN function calculates the median of sorted values in a range. This can add significant functionality to *1-2-3* and *Symphony*, which by themselves offer no quick means of finding median values. However, be-

SUMMARY OF @LIBRARY'S FUNCTIONS

Financial

- Cumulative interest on a loan, up to payment *n*
- Cumulative principal on a loan, up to payment *n*
- Effective annual interest rate, given annual nominal rate for *n* periods
- Nominal annual interest rate, given effective rate for *n* periods
- Interest component of payment *n*
- Principal component of payment *n*
- Fixed payment for an annuity due
- Future value of an investment, after compounding by each value in a range

Lookup

- Content of cell in table, located by row and column labels
- Horizontal-table lookup (exact matches only)
- Vertical-table lookup (exact matches only)

String

- Deletion of *n* characters in a string from a given starting position
- Test for matching strings, ignoring case and spaces

Statistical

- Median of sorted range of values
- Average of a range, ignoring labels, NAs, ERRs, and blank cells
- Number of cells containing values in a range, ignoring labels, NAs, ERRs, and blank cells
- Maximum value in a range, ignoring labels, NAs, ERRs, and blank cells
- Minimum value in a range, ignoring labels, NAs, ERRs, and blank cells
- Biased standard deviation of a range, using *n* denominator
- Unbiased standard deviation of a range, using *n-1* denominator
- Sum of a range, ignoring labels, NAs, ERRs, and blank cells
- Biased variance of a range, using *n* denominator
- Unbiased variance of a range, using $n-1$ denominator
- P value of a Z test

Date/Time/Calendar

- Day of week as a label (for example, *Monday* or *Mon*)
- Date in letter format (for example *January 1, 1988*)
- Day of the week as a number from 1 to 7
- Serial number date of *n* working days before/after a specified date

Mathematical

- Average of the product of rows/columns
- Sum of the product of rows/columns (inner product)
- Sum of every *n*th element in a range
- *x* rounded to nearest multiple of *n*
- Number of combinations of *n* things taken *r* at a time
- Number of permutations of *n* things taken *r* at a time
- Base 10 (decimal) to base 16 (hexadecimal) conversion, and vice versa
- *x* factorial (*x*!)
- Degree-to-radian conversion
- Radian-to-degree conversion

Logical Test

- Test whether *x* is odd

System

- Test whether a specified file exists
- Indicate type of display adapter attached
- Indicate amount of installed RAM or available extended memory
- Test whether printer is on-line
- Produce a tone at specified frequency and duration

Miscellaneous

- Sum of cells in rows matching specified criteria
- Length of widest label in a column
- Width of range, expressed in a number of characters
- Number of occurrences of *x* in a range

cause @MEDIAN works only with sorted values, if you want to get the median of a list of values contained in a table, you have to either sort the entire table by the range of values in question or copy the values to another area of your worksheet, where you sort them before using @MEDIAN.

HELP FOR AUTOMATED APPLICATIONS

@Library includes several @functions that are more useful for macro programming than for your interactive work with *1-2-3* or *Symphony* (see the functions listed in the Lookup, String, and System sections of the "Summary of *@Library*'s Functions" box). Of these, @PRTREADY, which tells you whether or not the printer is on-line, merits special mention. This function makes it easier to write a macro that detects an off-line printer, pauses, prompts you to turn on or connect the printer, and then prints. The alternative method, using the Lotus {ONERROR} command, requires more macro code.

One caveat for macro writers: If you use @functions from *@Library* in macro programs intended for use elsewhere in your organization or for commercial sale, keep in mind that users must have *@Library* installed in order to use those programs.

In general, *@Library*'s @functions are as easy to learn as *1-2-3*'s and *Symphony*'s. If you have difficulty remembering the syntax of your @functions, you can turn to either the included quick-reference chart or the optional on-line help facility. The documentation is adequate, but more illustrated sample applications would help you understand some of the @functions more readily. ■

IN BRIEF

@Library Volume I Version 1.0. IRG Information Systems, 100 North Country Rd., Setauket, NY 11733; 516-689-7682. Runs on the IBM PC, PC XT, PC AT, the PS/2 series, and compatible computers. Requires *1-2-3* Release 2 or higher or *Symphony* Release 1 or higher and DOS 2.0 or higher. Requires 22K of RAM, 13K for the optional help facility, 22K for the Add-In Manager (*1-2-3* only), plus the minimum RAM required for *1-2-3* or *Symphony*. Released 3/88. $79.95. Not copy-protected; 90-day warranty includes defective-media replacement ($25 replacement charge thereafter). Demo disk, $15.

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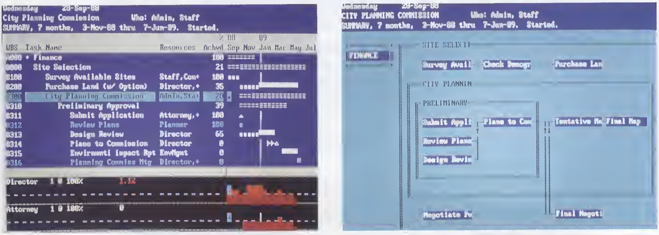
TIME LINE

Instant Gantt charts bring the flexibility of what-if analysis to project management.

BY MICHAEL J. BURGARD



```
Wednesday       28-Sep-88
City Planning Commission        Who: Admin, Staff
SUMMARY, 7 months,  3-Nov-88 thru  7-Jun-89.  Started.
                                                       / 88      89
WBS  Task Name                    Resources   Achvd Sep Nov Jan Mar May Jul
A000 • Finance                                  100
0000   Site Selection                            21
0100     Survey Available Sites   Staff,Con+    100
0200     Purchase Land (w/ Option) Director,+    35
0300     City Planning Commission  Admin,Sta+    20
0310       Preliminary Approval                  39
0311         Submit Application   Attorney,+    100
0312         Review Plans         Planner       100
0313         Design Review        Director       65
0314         Plans to Commission  Director        0
0315         Envirnmntl impact Rpt EnvMgmt        0
0316         Planning Commiss Mtg Director,+      0

Director   1 @ 100%       1.12

Attorney   1 @ 100%       0
```

```
Wednesday       28-Sep-88
CITY PLANNING COMMISSION        Who: Admin, Staff
SUMMARY, 7 months,  3-Nov-88 thru  7-Jun-89.  Started.
```

Time Line generates a Gantt chart (left) as you plan your project. The histograms that appear on the bottom of the screen show how much of each resource you've allocated to other tasks. The PERT chart (right) is a network diagram that depicts the relationships among your tasks.

If you manage projects, chances are that you can do that work on a personal computer with a project-management program. If you use a spreadsheet to do the budgeting and analysis associated with your projects, you want a project-management program that can export schedules and financial data to your spreadsheet.

Time Line Version 3.0 is such a program. This comprehensive, stand-alone project manager diagrams your schedule as you plan, lets you easily manipulate your data, and produces a variety of thorough reports that you can export to *1-2-3*, *Symphony*, and any other program that can read ASCII files. All of those things make this $595 program a good choice if you manage large projects.

Time Line's central planning tool is the Gantt chart, a type of bar chart that depicts on a calendar the time occupied by each of the project's tasks. The program generates this chart as you enter information about each task. The Gantt chart lets you see the bottlenecks and idle time inherent in your plan so that you can eliminate them before you run into trouble.

To satisfy your need both for a global perspective of your project and for lots of detail, you can alter the Gantt chart to show as much or as little information as you wish. For example, you can display tasks by name only, or you can add the names of resources, start dates, end dates, and other notes.

As you plan your project, you can use *Time Line*'s outline feature to break larger tasks into smaller ones. That provides two advantages. First, by working on the details of each task, you'll probably produce more accurate plans than if you work on a more general level. Second, outlining lets you integrate plans for separate projects that share the same resources. In this way, *Time Line* can keep track of how much of a given resource has already been allocated to other projects.

Time Line helps you manage resources in other ways as well. The program lets you create flexible schedules of available working hours and displays one or more histograms that tell you how much of any resource you've already committed. Also, if you've allocated more resources than are available in a given time period, the program can automatically reschedule your project.

Before you enter a project's tasks, you create a special-purpose calendar that specifies workdays, hours worked per day, available resources (such as people, equipment, or contracted services), and the costs of those resources. Then, as you enter tasks, you assign one or more resources to a task and specify the start date, the number of work hours the task will require, and, if the resource is a person, the percentage of the person's time devoted to the task. *Time Line* calculates the total time needed to complete the task, displays its duration on the Gantt chart, calculates the costs per task, and stores that

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Michael J. Burgard is a free-lance writer and management consultant from Bozeman, Montana.

cost for use in your reports.

Time Line displays up to five resource histograms on the same screen as the Gantt chart and updates them as you enter each new task, so you always know where you stand. If the histogram indicates that you've overallocated a resource, you can use *Time Line*'s resource-leveling feature to reschedule each task to fix things.

As you enter a task, you specify its relationship to the other tasks in the schedule. For example, you may specify that one task may not begin before another finishes. *Time Line* takes such relationships into account when it calculates the duration of each task. The program also uses this information to determine your project's critical path—that is, the sequence of tasks in which any delay will stall the entire project.

TIME LINE HELPS YOU ANALYZE AND CONTROL A PROJECT ONCE IT'S UNDER WAY.

Time Line's PERT chart expresses all of these relationships visually as a network of related tasks. Before rescheduling a task, you can consult the PERT chart to determine quickly whether the change will affect a task on your project's critical path. The PERT chart also helps you to spot unnecessary or illogical relationships between tasks that can delay the entire project.

Time Line also helps you analyze and control the project once it's underway. You can sort tasks so that, for example, you can see where you're spending the most money, or you can sort by due date to see which deadlines are imminent. You can also display a subset of tasks, known as filtering, and report on only those tasks that meet certain criteria. For example, you can filter to select tasks associated with a particular employee or with some other resource.

Used together, sorting and filtering can be even more helpful. For example, suppose you're planning a project that requires some mainframe time and you need to set up a schedule for that time. You can get the information you need by first filtering your tasks to show only those that use the mainframe and then sorting the mainframe-related tasks by their starting dates.

Time Line includes a number of predefined reports, any of which you can export to *1-2-3* or *Symphony* for manipulation. Some of these are cross-tabulation reports, which are especially useful to export to your spreadsheet because they can provide the basis for cash flow worksheets. For example, one cross-tabulation report, a "task versus time" report, shows the distribution of costs by task over weeks, months, or whatever period you specify.

Whether you intend to export or to print your reports, you can control their content by filtering and sorting the information they contain. However, you may find you lack the control you need to get a printout of your Gantt chart, which almost always occupies more than one page width. *Time Line* cannot print continuously sideways, so in order to avoid having to tape together your printed pages, you'll need to use a sideways printing utility such as *Duet* (Consumer's Software, Gilroy, Calif.) or *Sideways* (Funk Software, Cambridge, Mass.).

Time Line Version 3.0 is a powerhouse, and of course that means it takes up space. The program requires 640K of RAM and 2.5 megabytes of space on your hard disk. Version 2.0 of the product requires less memory and less storage, but it is less capable. If you are considering the product, talk with the publisher about what the tradeoffs are between the two versions.

Finally, don't expect to be up and running immediately with a program as multifaceted as this. The help menu, documentation, and keyboard template are helpful educational tools, but the program takes time to master. ■

IN BRIEF

Time Line Version 3.0. Symantec Corp., 505-B San Marin Dr., Novato, CA 94945; 415-898-1297. Runs on the IBM PC, PC XT, PC AT, PS/2, and compatible computers. Requires DOS 2.0 or higher, 640K of RAM, a hard disk, and a Hercules or IBM CGA, EGA, or VGA graphics card. Released 3/88. $595; available on either 5¼-inch or 3½-inch disks. Not copy-protected; 90-day defective-disk warranty.

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CIRCLE 119 ON READER SERVICE CARD

NEW PRODUCTS

Compaq SLT/286: A New Leader in Laptops, for Now

In October Compaq finally joined the laptop crowd. The $5,399 Compaq SLT/286 Model 20, with a 20-megabyte hard disk, and the $5,999 Compaq SLT/286 Model 40, with a 40-megabyte hard disk, are a bit more expensive than comparable machines from Toshiba, Zenith, NEC, and Grid.

While the Compaq machine contains some incremental improvements, such as the high-quality display and options that can transform it into a desktop computer, it lacks any astounding performance breakthroughs. It is instead remarkable for the consistently high performance of all of its components.

That makes the Compaq a good value in today's market. However, since it isn't terribly far ahead of its competitors, the red-hot laptop industry may produce even better machines for you to choose among if you can wait until later this year.

The SLT/286 uses a 12-MHz, low-power version of the 80286 processor and has a socket for a 12-MHz numeric coprocessor. It comes with 640K of RAM, and you can add another 3 megabytes on the motherboard. Memory above 640K can function as expanded memory compatible with version 3.2 of the Lotus/Intel/Microsoft Expanded-Memory Specification, but not with the more recent version 4.0. That means you'll be able to use your expanded memory to store data but not to store programs.

The SLT/286 offers ample long-term storage: a 20-megabyte disk or a 40-megabyte disk. Both sizes work as quickly as the better hard disks for desktop computers. Accompanying disk-caching software further improves their performance. The SLT/286 also includes a 3½-inch, 1.44-megabyte disk drive, a parallel port, and a serial port.

You can buy an optional module containing a 5¼-inch floppy-disk drive or a 40-megabyte tape-backup system. However, you can connect just one such module at a time. Because the chassis in which the floppy-disk drive or the tape-backup drive mounts is separate from the laptop unit, these options seem intended for use when you're at the office rather than on the road.

The optional Desktop Expansion Base, which the Compaq mounts onto when you're at the office, lets you use IBM PC AT boards.

The computer measures 4 inches high, 13½ inches wide, and 8½ inches deep, making it convenient for shallow spaces like airline tray tables. Despite its compact size, at 14 pounds, the Compaq is among the heaviest of the 80286-based laptops. With the separate power supply, a carrying case, an extra battery pack, and a cable or two, you're lugging 18 or 19 pounds.

The SLT/286's backlit, supertwist liquid crystal display uses the Video Graphics Array (VGA), as IBM's PS/2 computers do. The SLT/286 screen displays 8 levels of gray scaling at its full 640-by-480-pixel resolution or 16 levels of gray scaling at 320-by-200-pixel resolution. That means that the screen, which measures 10 inches diagonally, is clearer than those of most other laptops and the clearest among LCD screens.

The display is also faster. The VGA's 16-bit design makes it approximately 50% faster than the 8-bit systems found on many other laptops. The video adapter also serves an external port so that you can connect a larger monitor when you use the computer in an office.

The keyboard's 82 keys compare with 101 keys of desktop-based 80286 computers such as the IBM PC AT. The keyboard doesn't have a separate numeric keypad; instead one overlays some of the alphanumeric keys. If that's not good enough for you, Compaq sells both a separate numeric keypad that plugs into the regular keyboard and, for use back at the office, a full-size keyboard that entirely replaces the original. You can place the keyboard in front of the SLT/286's system unit, or in more

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cramped quarters, you can nestle it just in front of the display, atop the system unit.

Compaq claims that with the battery pack fully charged, the computer runs for more than three hours. Charging the batteries with the included brick-style, 1¾-pound, AC power supply/battery charger takes just 90 minutes with the computer off or about three hours with it running. If you expect to be away from an AC outlet for longer periods of time, you can bring with you an extra battery pack ($129).

In addition to the standard unit, the SLT/286 has several optional components, the most prominent being the $999 Desktop Expansion Base that the laptop mounts onto when you use it at your office. The base represents the strongest attempt by any company yet to make a laptop your sole computer. It includes two 8/16-bit expansion slots, which accept the same boards as an IBM PC AT. It also has a power supply and three more interface ports, so you don't need to unplug such things as printers and modems when you take away the portable.

THE BASE REPRESENTS THE STRONGEST ATTEMPT YET TO MAKE A LAPTOP YOUR SOLE COMPUTER.

Does it make sense to have just one computer for both office and travel? If you now transfer files from your desktop to your laptop before you leave the office and vice versa when you return, you can eliminate that process if you use just the laptop. But if you need a laptop only for working at home, for what you'd spend on the SLT/286 and its Desktop Expansion Base, you could equip both your home and office with desktop machines. Then you wouldn't have to carry a computer back and forth and you'd be in less of a bind if one machine broke down. *—Bruce Brown*

CIRCLE 1 ON READER SERVICE CARD

NEC Ultralite: 4.4 Pounds and a Caveat or Two

NEC Home Electronics' Ultralite laptop is noteworthy for its minuscule size, extremely light weight, and use of a new form of mass storage. However, its lack of some basic functions, such as a floppy-disk drive, relegates the machine to a special-purpose role.

NEC's breakthrough computer weighs just 4.4 pounds and is smaller than a ream of paper.

First the good news. The $2,999 Ultralite weighs just 4.4 pounds, including batteries. It measures 8.3 inches deep, 11.75 inches wide, and only 1.4 inches high. To put that in perspective, a ream of standard copy paper is about the same depth and width and half again as tall.

The machine's mass-storage device, what NEC calls a silicon hard disk, is a chip that acts like a hard disk. The silicon disk can hold both applications and data, even when the computer is off. The best part of this new storage medium is speed. Its rated access time of 9 milliseconds makes it the fastest form of mass storage available today.

However, the disk holds only 1 megabyte, a paltry amount for a mass-storage device. If you want to buy the 2-megabyte version, you'll be disappointed by the silicon disk's other distinguishing feature. At $700 for the extra megabyte, it's the costliest form of mass storage available today. It's no surprise that no price accompanied the announcement of plans to allow users to upgrade to a 4- or 8-megabyte version of the Ultralite. Note that you cannot upgrade a 1-megabyte machine to 2 megabytes.

More bad news. There are two features you'd expect in a laptop that the minimum configuration of the Ultralite doesn't have: a floppy-disk drive and a parallel port. When you need to exchange data with other computers, the lack of a floppy-disk drive forces you either to connect the Ultralite's serial port to that of the other computer via a supplied cable or to transmit that data via the computer's internal 2400-baud modem. The absence of a parallel port means you can't hook up most printers. Unless you have access to a serial-type printer or wish to spend an additional several hundred dollars on a serial-to-parallel converter, you'll have to transfer your data to another computer and print from it.

You can purchase a 3½-inch, 1.44-megabyte floppy-disk drive, which contains a parallel port and costs $399. However, it isn't integrated into the computer's chassis, so you will have to carry it separately. NEC is betting that you'll stick with its silicon disk and buy your applications software on special ROM cartridges through NEC dealers.

While you'll probably be able to get many of the best-selling programs on ROM cartridges, your chances of getting other titles may be slim. The silicon-disk scheme also contains a hidden cost. While more and more vendors provide software in 3½-inch format at no extra charge, they are not likely to do that with ROM cartridges. NEC expects the cartridges to sell for approximately the same price as the software would on 5¼-inch disks.

The Ultralite uses an 8086-compatible microprocessor running at 9.83 MHz and has 640K of RAM. Keep in mind that if you purchase your applications software on a ROM cartridge, that software still uses RAM, just as if you purchased that software on a disk. The screen is an electroluminescent backlit liquid crystal display with 640-by-200-

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We encourage you to *comment* on, as well as evaluate, the contents of this issue. Thanks in advance.

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Your comments about *LOTUS* magazine help us bring you the best editorial product each month. To rate the articles in this issue, scan the list below and refer to the EDITORIAL EVALUATION card on the bottom of the insert to the left. Identify the number corresponding to each article, then circle the number on the card that reflects your rating.

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pixel resolution in text mode and IBM Color Graphics Adapter resolution in graphics mode. The 78-key keyboard includes 12 function keys across the top.

The Ultralite's brick-style battery can operate for two to three hours per day and takes from six to eight hours to recharge. Because the battery isn't removable, you can't carry extra batteries with you to replace a drained battery. NEC says that it is working on a replaceable battery for the Ultralite.

DOS 3.3, Microsoft's MS-DOS Manager, and Traveling Software's LapLink are in the computer's permanent ROM. The MS-DOS Manager lets you operate DOS via menus and LapLink lets you exchange files with other computers via direct connection to your serial port.

If you don't need to print, can get your favorite program on a NEC ROM card, don't need more than 1 megabyte of disk space, and don't need to run the computer on batteries for more than three hours each day, the Ultralite's convenient size and weight may be just what your chiropractor ordered. For most of us, however, the Ultralite is important not because of what it is, but because of what it tells us is coming: truly portable computers. —*Bruce Brown*

CIRCLE 2 ON READER SERVICE CARD

WORKSHEET UTILITIES

Build 3-D Spreadsheets or View Two at Once

Look&Link consists of two *1-2-3* add-ins. *Link* (35K of RAM) lets you dynamically link and consolidate worksheets. Since *Link* allows you to link worksheets on disk, only the amount of available disk space limits the number of worksheets you can connect. *Link* also allows you to load several worksheets into memory at the same time. You can build worksheets that get information from or control operations in other worksheets. A dependency tree displays all linked files. While you are in a current worksheet, *Look* (55K of RAM) lets you view and scroll around another file in a window. This helps in building linked multisheet operations. You can enter data only in the active file in RAM, but you can make either file active.

Look&Link requires *1-2-3* Release 2/2.01, runs on the IBM PC, PS/2, and compatible computers, and supports any version of LIM-EMS. It costs $99.95, from Personics Corp., 63 Great Rd., Maynard, MA 01754; 508-897-1575.

CIRCLE 3 ON READER SERVICE CARD

Put 1-2-3 and dBase Data into Your Word Processor

Slice Duet, Slice 1-2-3, and *dSlice* let you copy data from *1-2-3* or *dBase* files into most word-processing files. *Slice Duet* ($149) works with both *1-2-3* and *dBase*; *Slice 1-2-3* and *dSlice* ($99 each) work only with *1-2-3* and *dBase*, respectively. While using a word processor, you can pop up the memory-resident *Slice*, display a list of *1-2-3* or *dBase* files, choose one to work in, then select and edit even noncontiguous data and copy it into the word-processing document. *Slice Duet* and *dSlice* can create mail-merge files for *WordPerfect, WordStar*, and *Microsoft Word* by selecting names and addresses from *dBase* files.

Slice products use 40K of RAM, work with any release of *1-2-3* or *dBase*, and run on the IBM PC, PS/2, and compatible computers. They are from LightningWord Corp., 1601 Civic Center Dr., Suite 206, Santa Clara, CA 95050; 800-426-4381, in Calif. 408-241-1990.

CIRCLE 4 ON READER SERVICE CARD

Move Data Among Spreadsheet and Database Files

DataShuttle lets you transfer data from spreadsheets, databases, and ASCII files in and out of all versions of *1-2-3, Symphony, dBase, Framework, Excel, Quattro*, and compatible programs. You can automate all functions.

While you're using *1-2-3*, *DataShuttle* lets you display any file on a floppy or hard disk that's in a supported file format, specify the rows and fields you wish to copy, and import them directly to the worksheet. You can import data

JULIA TALCOTT

selectively, based on comparing fields to alphanumeric values or cells, and specify the format of incoming data. You can transfer data from an unlimited number of files from different source formats in one operation.

DataShuttle runs on the IBM PC, PS/2, and compatible computers with 256K of RAM. A hard disk is recommended. It costs $129.95, from Softway, 500 Sutter St., Suite 222, San Francisco, CA 94102; 800-338-2852, in Calif. 415-397-4666.

CIRCLE 5 ON READER SERVICE CARD

BUSINESS TOOLS

Library Includes 20 General-Purpose Financial @Functions

Financial Toolkit, a *1-2-3* add-in, lets you calculate payments at the beginning or end of any period, or uneven, partial, and interest-only payment periods for bonds, loans, leases, and other financial instruments. It upgrades all *1-2-3* financial functions to allow for variable interest rates, as well as variable payments. Two other @functions let you translate between nominal and effective yields. Depreciation @functions have been updated to include all depreciation methods consistent with the Tax Reform Act of 1986.

Financial Toolkit uses 15K of RAM, requires *1-2-3* Release 2/2.01, and runs on the IBM PC, PS/2, and compatible computers. It costs $99, from S. B. Assoc., P.O. Box 12, Wayland, MA 01778; 800-336-6644.

CIRCLE 6 ON READER SERVICE CARD

Andrew Tobias's Tax Package Features Advice

Andrew Tobias' Tax Cut prompts you to enter financial information, then evaluates your potential tax obligation, determines the optimum tax strategy, and selects the correct forms to file. You can print IRS form 1040 and 22 other approved forms and schedules from the program. Help screens written by Tobias explain choices along the way. The program provides an interface with *Managing Your Money*, but not with any other software. The manufacturer says that you can export all your data from *Managing Your Money* with one keystroke.

Tax Cut uses 312K of RAM and runs on the IBM PC, PS/2, and compatible computers. It costs $79.95, from Meca Ventures, 355 Riverside Ave., Westport, CT 06880; 203-226-2400.

CIRCLE 7 ON READER SERVICE CARD

Checkbook Program Geared for Small Businesses

Andrew Tobias' Checkwrite Plus is designed for businesses whose basic instrument of financial control is their checkbook. The program can integrate multiple accounts, such as checking, savings, and credit cards. It lets you print checks and prepare profit-and-loss, loan amortization, and tax statements. You can also create pie, bar, and line charts of your account activity. Menu selections allow you to export data to *Managing Your Money*, any release of *1-2-3*, and other programs.

Checkwrite Plus uses 256K of RAM and runs on the IBM PC, PS/2, and compatible computers. It costs $49.95, from Meca Ventures, 355 Riverside Ave., Westport, CT 06880; 203-226-2400.

CIRCLE 8 ON READER SERVICE CARD

SECURITIES SOFTWARE

@Functions Cover U.S. and Foreign Bonds

Bond Yield Calculations is a *1-2-3* and *Symphony* add-in that conforms to the Securities Industry Association's standards. As opposed to a conventional securities calculator that evaluates one security at a time, the add-in lets you analyze a whole portfolio at once. Among other things, you can calculate yield, duration of time to maturity, volatility, and accrued interest, and you can determine the price of an instrument by using a known yield amount.

Some of the 20 @functions relate to U.S. Treasury, government-agency, corporate, and zero-coupon bonds. Others let you process European, U.K., and Japanese securities and other interest bases: actual/360, actual/actual, 30/360, 30E(European)/360, and actual/365.

Bond Yield Calculations uses 32K of RAM, requires *1-2-3* Release 2/2.01 or any version of *Symphony*, and runs on the IBM PC, PS/2, and compatible computers. It costs $595, from Intex Solutions, 161 Highland Ave., Needham, MA 02194; 617-449-6222.

CIRCLE 9 ON READER SERVICE CARD

40 @Functions for Bond and Note Calculations

@Fixed_Income is a *1-2-3* and *Symphony* add-in that conforms to the Securities Industry Association's 1986 guidelines. Twenty-four @functions calculate bond prices and yields and can be applied to domestic and foreign securities. You can find prices based on regular and irregular periods, and you can determine interest at maturity, discounts, and odd-coupon and zero-coupon yields. @Duration gives you Treasury note prices at a modified and full duration of time to maturity. Another @function lets you convert currency values into fractional dollars.

Ten @functions relate to the time value of money. Date @functions let you compute the following number of days divided by number of days: 30/360, 30E(European)/360, actual/360, actual/actual, and actual/365. Calendar @functions let you compute the number of business days between two dates.

@Fixed_Income uses 30K of RAM, requires *1-2-3* Release 2/2.01 or any version of *Symphony*, and runs on the IBM PC, PS/2, and compatible computers. It costs $695; each additional package costs $100. Upgrades to a *1-2-3* Release 3.0 version will be free when it becomes available. It's from Spreadsheet Solutions, 600 Old Country Rd., Garden City, NY 11530; 800-634-8509.

CIRCLE 10 ON READER SERVICE CARD

GRAPHICS

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tions include five fonts in a range of sizes and print attributes, and 12 fill patterns. The program reads ASCII files, as well as ranges and named graphs from *1-2-3* and *Symphony* worksheets. It works with a variety of plotters and dot-matrix and laser printers.

The software works with any release of *1-2-3* and *Symphony* and runs on the IBM PC, PS/2, and compatible computers with 320K of RAM, a hard disk, and a graphics card. It costs $149, from Software Publishing Corp., 1901 Landings Dr., Mountain View, CA 94039; 415-962-8910.

CIRCLE 11 ON READER SERVICE CARD

Utility Transfers Files Among Many Graphics Packages

Reflection lets you interchange graphics files stored in the following formats: Hewlett-Packard's HPGL, JT fax, Ricoh fax, Group 3 fax, *WordPerfect*'s WPG, *Dr. Halo*'s CUT, *DPG*'s CUT, *PC Paintbrush*'s PCX, *Inset*'s PIX, HP LaserJet's HPC, *MacPaint*'s MAC, Amiga's IFF, and TIFF files from scanners. You can also use ASCII or *1-2-3* or *Symphony* PIC text files to input data and create *PostScript*-generated output.

The utility lets you reproduce text and graphics screens on slides, paper, and transparencies. Graphics-screen images taken from your IBM CGA, EGA, VGA, and Hercules cards or cards that run on the Toshiba T3100 or AT&T 6300 produce higher-quality images than you see on your screen.

Reflection uses 45K of RAM for screen captures and runs on the IBM PC, PS/2, and compatible computers with one floppy drive and a graphics card. It costs $99, from International Microcomputer Software, 1299 Fourth St., San Raphael, CA 94901; 800-222-4723, in Calif. 800-562-4723.

CIRCLE 12 ON READER SERVICE CARD

SCANNER/PC INTERFACES

Put Scanned and Faxed Documents into PC Applications

TrueScan lets you integrate the output of most scanners and fax cards with files from most word-processing, spreadsheet, and desktop-publishing programs, as well as with ASCII files. It processes both typeset and computer-generated print, including dot matrix, and recognizes type in 8- to 28-point sizes. That means you can incorporate virtually any printed data into your program files. Just the reverse of a printer, it puts data from a page into your PC program.

The scanner interface retains original print attributes such as boldface and italic, and layouts such as columns and tables. It lets you input data in character-based (text), bit-mapped (graphics), or both formats and works at a speed of up to 100 characters per second.

TrueScan runs on the IBM PC AT, any '386-based PC, and compatible computers with 512K of RAM, a hard disk, and an empty full-length slot. The Model S costs $2,495; the Model E is 30% faster than the Model S, rotates pages, and costs $3,495. The scanner is from Calera Recognition Systems, 2500 Augustine Dr., Santa Clara, CA 95054; 408-986-8006.

CIRCLE 13 ON READER SERVICE CARD

Put Huge Scanned Images into Word-Processing Files

OmniPage MS-DOS Version 1.0 board and software let you copy scanner-generated files into word-processing and ASCII files. You can capture text, graphics, or both and retains the print attributes and formats. The product recognizes type in 8- to 72-point sizes.

The product has drivers for the HP ScanJet and Canon IX-12 scanners but works with most popular desktop scanners. The card has a 68020 coprocessor and 2 megabytes of RAM.

OmniPage MS-DOS version 1.0 runs on the IBM PC XT, PC AT, and compatible computers with 640K of RAM and a hard disk. It requires *Microsoft Windows* Version 2.03 or higher and includes a run-time version. It costs $2,495, from Caere Corp., 100 Cooper Ct., Los Gatos, CA 95030; 800-535-SCAN.

CIRCLE 14 ON READER SERVICE CARD

OTHERS: CD-ROM, FAX

CD-ROM Monthly Features 10 Computer Magazines

Computer Library is a CD-ROM disk holding the complete editorial contents of the 12 most current issues of *A+*, *Communications of the ACM*, *Digital Review*, *Government Computer News*, *LOTUS*, *MacUser*, *Microsoft Systems Journal*, *PC Magazine*, *PC Tech Journal*, and *PC Week*. Each month you receive a disk containing the 12 most recent issues of each magazine. The disk also has abstracts of articles on computers and computing from 120 other periodicals, including *The New York Times* national edition.

The Library requires a CD-ROM drive that works with Microsoft MS-DOS CD-ROM extensions; an IBM PC, PS/2, or compatible computer; a hard disk; 512K of RAM; and DOS 3.1 or higher. A one-year subscription, including monthly updates, costs $695, plus tax and $25 for the year's shipping. You can purchase the Sony CD-ROM Drive Unit for $635, but only at the time you subscribe. It's from Ziff Communications Co., One Park Ave., New York, NY 10016; 212-503-4400.

CIRCLE 15 ON READER SERVICE CARD

Software Offers Alternative to Fax Machine or Board

PC-Xpedite software and Xpedite service let you send and receive facsimile (fax) documents through your PC's modem. Using *PC-Xpedite*, you send any document capable of being formatted as an Epson print file or revisable word-processing file, including CAD drawings and spreadsheets, to your mailbox at the Xpedite Service Center. There your letterhead or other information can be added before your fax is sent to its destination. You download your incoming faxes from an electronic mailbox.

The product runs on the IBM PC, PS/2, and compatible computers with

IN *LOTUS* NEXT MONTH:

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- ***1-2-3* Macros: Save the Display**
- **Macro Basics: Write Function Keys into Your Macros**

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512K of RAM. It requires an asynchronous modem and a printer that supports graphics. The software costs $49. Xpedite service carries charges that the manufacturer claims are competitive with the cost of using a fax machine if you produce 150 to 200 pages per month. Also according to the company, Xpedite rates to Japan and Europe are less expensive than direct fax rates. The product is from Xpedite Systems, 446 State Highway 35, Eatontown, NJ 07724; 800-227-9379, in N.J. 201-389-3373.

CIRCLE 16 ON READER SERVICE CARD

UPGRADES

Lotus Freelance Plus Release 3.0 offers improved charting, drawing, and editing features and adds presentation functions. The program includes new chart formats, automatic chart layout, style control from within a chart, dynamic links between chart files and other data sources, and support for *1-2-3* Release 3.0 files. Drawing and editing tools include curve smoothing, snap-to-object command, align command, document preview, additional symbols and templates, and scanned-image support.

One feature, called Portfolio, helps you plan, create, and organize your presentations. In addition to letting you use paper, transparencies, or 35mm slides as a medium, the program now lets you use your PC screen to produce an automated slide show. You can run that presentation on another PC without *Freelance Plus.*

The program imports all *1-2-3, Symphony*, and *dBase* files, as well as SYLK, TIFF, CHT, DRW, CGM, GMF, and ASCII files. It exports *PostScript* EPS, HPGL, TIFF, and PIC files. All *Freelance Plus* Release 2.0 and 3.0 files are compatible.

Freelance Plus Release 3.0 runs on the IBM PC, PS/2, and compatible computers with 640K of RAM, a hard disk, and a graphics card. It supports most dot-matrix and laser printers, plotters, image recorders, and input devices. It costs $495, from Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; 800-TRADEUP.

CIRCLE 17 ON READER SERVICE CARD

101 Macros Plus for 1-2-3, has been upgraded. It adds more than 30 macros and has improved macro access. New macros let you delete all blank rows and columns in a range, calculate the median of a column of numbers, create organizational charts, change the width of groups of columns, find a string

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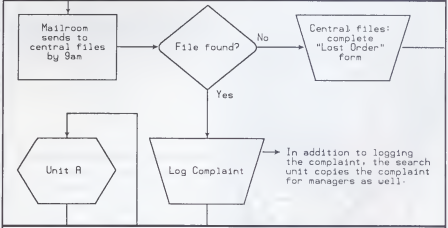
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CIRCLE 118 ON READER SERVICE CARD

within a string, and print alternate columns in a worksheet. The package lets you automatically gather selected macros into a separate file or pop up a list of abbreviated macro names to use as a menu.

101 Macros Plus uses 45K of RAM, works with all versions of *1-2-3*, and runs on the IBM PC, PS/2, and compatible computers. It costs $69.95, from Individual Software, 125 Shoreway Rd., Suite 3000, San Carlos, CA 94070; 800-331-3313, in Calif. 415-595-8855.

CIRCLE 18 ON READER SERVICE CARD

Bond$mart Version 2.1 now lets you calculate foreign fixed-income securities. It reads files from all versions of *1-2-3* and *Symphony*. You can set a range to calculate incremental steps, such as setting 0.05 intervals between 8% and 20%, to test buying and selling theories. A currency conversion table compares price values.

The program runs on the IBM PC, PS/2, and compatible computers. A hard disk and 512K of RAM are recommended. It costs $395, from MicroTempo, 122B North Bedford St., Arlington, VA 22201; 703-243-9603.

CIRCLE 19 ON READER SERVICE CARD

PFS: First Choice Version 3.0 augments its word-processing, database, spreadsheet, graphics, telecommunications, and report-writer features. The program now reads and writes *1-2-3* Release 2/2.01 files. You can now produce text charts, slides with multiple fonts, and PC-based automated slide shows to enhance business presentations.

The program runs on the IBM PC, PS/2, and compatible computers with 512K of RAM and a graphics card. It costs $159, from Software Publishing Corp., 1901 Landings Dr., Mountain View, CA 94039; 415-962-8910.

CIRCLE 20 ON READER SERVICE CARD

Draw Plus replaces *Windows Draw*. Enhancements let you use context-sensitive help, connect and fill irregular objects, rotate graphics and text in one-degree increments, snap objects to a ruler, and select line styles, end styles, and line widths. The eight different color palettes include gray scales. A menu selection lets you import *1-2-3* PIC and ASCII text files. The software also supports scanned images.

The program runs on the IBM PC, PS/2, and compatible computers with 512K of RAM, a hard disk, and an IBM EGA, VGA, or compatible graphics card for color. It costs $395 and includes a clip-art library, from Micrografx, 1303 Arapaho Rd., Richardson, TX 75081; 800-272-3729; in Tex., 214-234-1769.

CIRCLE 21 ON READER SERVICE CARD

TRAINING

Learn to Fix Your Computer

The videotape "Your PC..Inside-Out" uses nontechnical language to teach you how to repair, upgrade, and maintain an IBM PC, PC XT, PC AT, PS/2, or compatible computer. You can learn to add memory or a hard disk on a card. The package contains a diagnostic disk that identifies where a hardware problem may lie, a supplemental 135-page workbook/reference manual, and 11 tools, such as a chip puller and a set of screwdrivers.

The package contains a two-hour video in VHS or Beta format, manual, tools, and disk. It costs $280, from Data-Tech Institute, P.O. Box 2429, Clifton, NJ 07015; 201-478-5400.

CIRCLE 22 ON READER SERVICE CARD

Videotapes Teach Lotus Agenda

The "Lotus Agenda: Introduction to the Personal Information Manager" videotape teaches you the fundamentals of *Agenda*. A second video, "Lotus Agenda: Advanced Features," extends those skills. Each one-hour long video is divided into five lessons. Included are a practice disk with examples of business applications and a 90-page training and reference manual. Both 3½-inch and 5¼-inch practice disks come with each package.

The videos are available in VHS, Beta, and ¾-inch format, and the disks run on the IBM PC, PS/2, and compatible computers. The courses cost $275 apiece or $495 for both, from Anderson Soft-Teach, 2680 North First St., San Jose, CA 95134; 408-434-0100.

CIRCLE 23 ON READER SERVICE CARD

Tutorials Cover All the 1-2-3 @Functions

Indexer for 1-2-3, by Pro-Active Methods, features 20-second to 90-second demos that take you through all of *1-2-3*'s 90 @functions. Each demo is like a short slide show that you can stop whenever you wish to try out a function. One feature lets you locate any indexed word or subject from the *1-2-3* reference manual and six popular books, including *Using 1-2-3, Special Edition*; *1-2-3 Tips, Tricks, and Traps*; and *1-2-3 Command Language*.

The package requires *1-2-3* Release 2/2.01 and runs on the IBM PC and compatible computers with 640K of RAM. A hard disk is recommended. It costs $79.95 and is distributed by Goldata Computer Services, 2 Bryn Mawr Ave., Bryn Mawr, PA 19010; 800-432-3267.

CIRCLE 24 ON READER SERVICE CARD

BOOKS

Using Agenda ($21.95), by Mary Campbell, 762 pp., published October 1988, Osborne/McGraw-Hill, 2600 Tenth St., Berkeley, CA 94710; 800-322-3007.

CIRCLE 25 ON READER SERVICE CARD

The Lotus Guide to Agenda ($19.95), by Robert H. Flast and Lauren M. Flast, 416 pp., published October 1988, Addison-Wesley Publishing Co., Reading, MA 01867; 617-944-3700.

CIRCLE 26 ON READER SERVICE CARD

Lotus Agenda ($22.95), by Ian Sinclair, 208 pp., published September 1988, Blackwell Scientific Publications, PBS Div., P.O. Box 447, Brookline Village, MA 02147; 617-524-7678.

CIRCLE 27 ON READER SERVICE CARD

Information for New Products is supplied by the vendors and was up to date as of 11/10/88. Since production specifications change frequently, we recommend that you verify this information with a dealer before making a purchase.

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CIRCLE 198 ON READER SERVICE CARD

INSIDE-OUT LOGIC IS VERY CONFUSING

BY DANIEL SELIGMAN

Why am I so confused? Wait—don't answer that question. First let's talk about the Next computer. Like many of you who try to keep up with what's what in microcomputerland, I focused hard on the mid-October extravaganza produced by Steven Jobs, chairman of Next Inc. When Steve unveiled the Next Computer System, his face immediately appeared on the covers of *Newsweek* and *Business Week*, and *The Wall Street Journal* gave him more space than it gave Donald Trump. To be sure, Donald had an off day. All he did was buy the Eastern Shuttle.

What I learned from the avalanche of exposition was that either Steve has created a dazzling new technology that will forever change what people expect from personal computers, or he has trapped himself in an unpromising niche in the education market. Now you know why I am confused.

You may argue that Steve Jobs's new computer is a confusing special case, remote from the mainstream of PC evolution. My own sense is that the mainstream itself has become every bit as baffling as Steve and Next.

For example, you'd think IBM would qualify as the mainstream. But oddly enough, I cannot seem to find out how IBM is doing with the PS/2 personal computers it introduced early in 1987. People who seem quite knowledgeable are calling the PS/2 a brilliant technological achievement and a solid commercial success. Other expert witnesses rate it a flop on both counts. (Both views were expounded in *LOTUS*'s October issue, page 9.) In Hegelian dialectics, it is possible for propositions to be true while their opposites are also true. But in the personal-computer business, this inside-out logic is disconcerting.

ROY PENDLETON

I don't even have a handle on what IBM is *trying* to do. A major *Wall Street Journal* story last August left me thinking that the company wants to regain market share for its own PCs and, therefore, will limit the licenses that allow others to latch onto the PS/2 technology. But not long afterward, I read stories suggesting that IBM was kind of hurt because not too many folks came around asking for licenses for its Micro Channel architecture (MCA), and maybe it was also mortified because Dell and Tandy, the first two licensees, were slow to rush into production (presumably because demand for the technology was not exactly overwhelming).

My biggest Hegelian problem centers around the great architecture issue. What is the point of the Micro Channel architecture that IBM incorporated into most of the PS/2 line? IBM says that the point is to ensure greater speed, reliability, and data integrity. But there is an unusual amount of disagreement about whether MCA delivers the goods. The competition says that MCA is just another way of organizing a computer's data flow, that the MCA "bus" isn't particularly outstanding, and that its ultimate point is its incompatibility with PC AT add-in boards, which would give IBM a lock on the PC market if MCA became the industry standard.

For a while, I thought the "gang of nine" had simplified things for me. The gang, you will recall, consisted originally of Compaq and eight other IBM-compatible PC makers (the consortium has since grown beyond the original nine founders), all of whom stealthily got together in New York City in September and announced they were going to challenge Micro Channel architecture. Since the gang collectively sold about 43% more PCs than IBM, their proposed standard, called Extended Industry Standard Architecture (EISA), had to be taken seriously. At this point, I figured, we had a neat, two-horse race.

But then, in an October 10 *Computerworld* article, several gang-of-nine members strongly downplayed EISA. Moreover, it appears that perhaps IBM itself is not totally committed to MCA. The same article had sources close to IBM's PC division saying that the company is developing an 80386SX PC with an AT bus—the bus that MCA was supposed to replace.

Finally, what about operating systems? If the Next machine is a wild success, can Unix be far behind? And what does OS/2 imply for the future of poor old DOS? Is DOS doomed? Is OS/2 the only plausible alternative? Is DOS 4.0 startling, sizzling, intuitive, and powerful, as heavyweight critic Paul Somerson claimed in his *PC Computing* review? Or does it leave DOS lagging farther behind, as commentator Jim Seymour alleged in *PC Magazine*? All I ask is one belief I can cling to. ■

Daniel Seligman is a regular contributor to LOTUS *magazine.*

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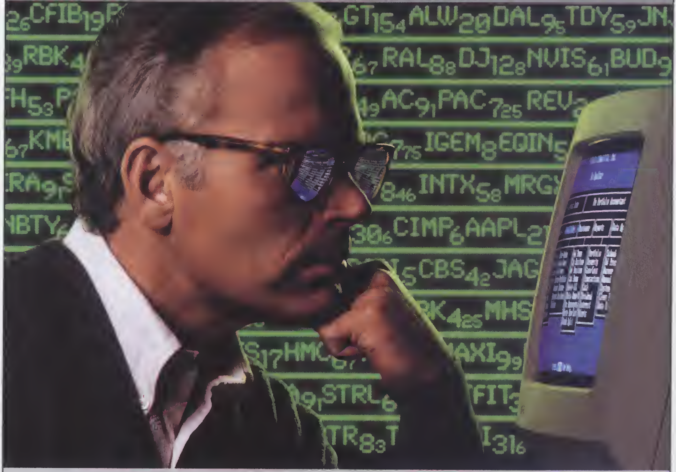

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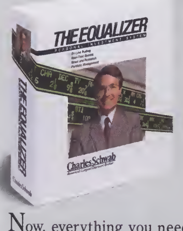

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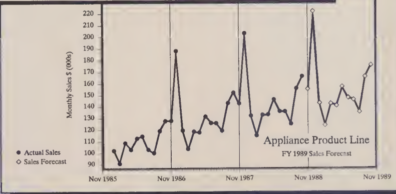
Series Type:    Monthly         Date      Forecast   Upper   Lower     S Factor
First Actual:         1       Nov 1988       156      158     153        1.03
Confidence                    Dec 1988       221      225     217        1.46
 Level:           95.0%       Jan 1989       143      148     139        0.95
 Interval:            3       Feb 1989       124      130     119        0.82
Mean:               129       Mar 1989       143      149     137        0.94
Std Deviation:       24       Apr 1989       141      148     135        0.92
Minimum:             91       May 1989       157      164     150        1.01
Maximum:            203       Jun 1989       147      155     140        0.94
Trend Line Slopes             Jul 1989       146      154     138        0.93
 Entire Range:     1.26       Aug 1989       135      144     127        0.86
 Last Half:        0.98       Sep 1989       166      174     157        1.04
Seasonality                   Oct 1989       176      185     166        1.10
 Auto(+):            12
```



Business forecasts drive business decisions. Better forecasts mean better decisions.

How many units will be sold? How many parts to order? How many assemblies to manufacture? How high will expenses be? How many students will register? How many rooms will be rented? How much cash will be needed? How do you know?

You can *hire* a forecasting expert. A statistician who may use Auto-correlation, Brown's Double Exponential Smoothing, and Linear Regression Analysis. And then apply experience and judgment to arrive at your forecast. In a day, or maybe a week. For $100 an hour.

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Start with history data, such as monthly sales for the last two years, on a Lotus 1-2-3® or Symphony® worksheet. Then invoke the TrendSetter Add-in, and:

➊ Show TrendSetter where your data is,

➋ Tell it how far in the future to forecast,

➌ Show it where to put the results, and

➍ "Go".

TrendSetter puts results directly on your worksheet, showing upper and lower bounds for the forecast plus other measures of statistical accuracy. The manual explains what they mean. You can easily modify forecasts with Lotus to reflect your own judgment. TrendSetter even writes Lotus macros so you can graph your forecasts at the press of a key.

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